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STANDARD ENGINEERING INSTALLATION PACKAGE. WIDEBAND SECURE VOIC--ETC(U)

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LEVEL II

SEIP 035

USACC

VOICE OF THE ARMY

STANDARD ENGINEERING INSTALLATION PACKAGE

WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

18 May 1979

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HEADQUARTERS
U. S. ARMY COMMUNICATIONS COMMAND
FORT HUACHUCA, ARIZONA 85613

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SEIP 035	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) (6) Standard Engineering Installation Package • Wideband Secure Voice Network Extension Project •		5. TYPE OF REPORT & PERIOD COVERED (9) Final rept. ~~Final, Indefinite~~
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Communications-Electronics Engineering Installation Agency ATTN: CCC-CED-SEP, Fort Huachuca, AZ 85613		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Communications Command ATTN: CC-PA-AMP Fort Huachuca, AZ 85613		12. REPORT DATE (11) 18 May 79
		13. NUMBER OF PAGES (12) 377p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) US Army Communications Command ATTN: CC-OPS-SM Fort Huachuca, AZ 85613		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

This document has been approved for public release and sale; its distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Wideband Secure Voice Network Extension Project (WBSVNEP)
link interconnect equipment
secure voice terminal equipment
SECORD wideband trunk applique unit

408562

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This Standard Engineering Installation Package (SEIP) provides guidance for detailed planning, engineering, installing, and testing of link interconnect equipment used to interface secure voice terminal equipment to satellite or other terrestrial media. Document includes site survey and data checklist, installation specifications and instructions, engineering installation drawings, and operational test procedures.

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Item 19 (contd).

satellite earth terminal
CV-3034A/G analog-to-digital converter
AN/GSC-24(V) multiplexer set
AN/USC-26 group data modem (GDM)
MD-920/G and MD-921/G modems

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS COMMAND
Fort Huachuca, Arizona 85613

USACC SEIP
No. 035 — 18 May 1979

Standard Engineering Installation Package
WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

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SECTION 1. GENERAL

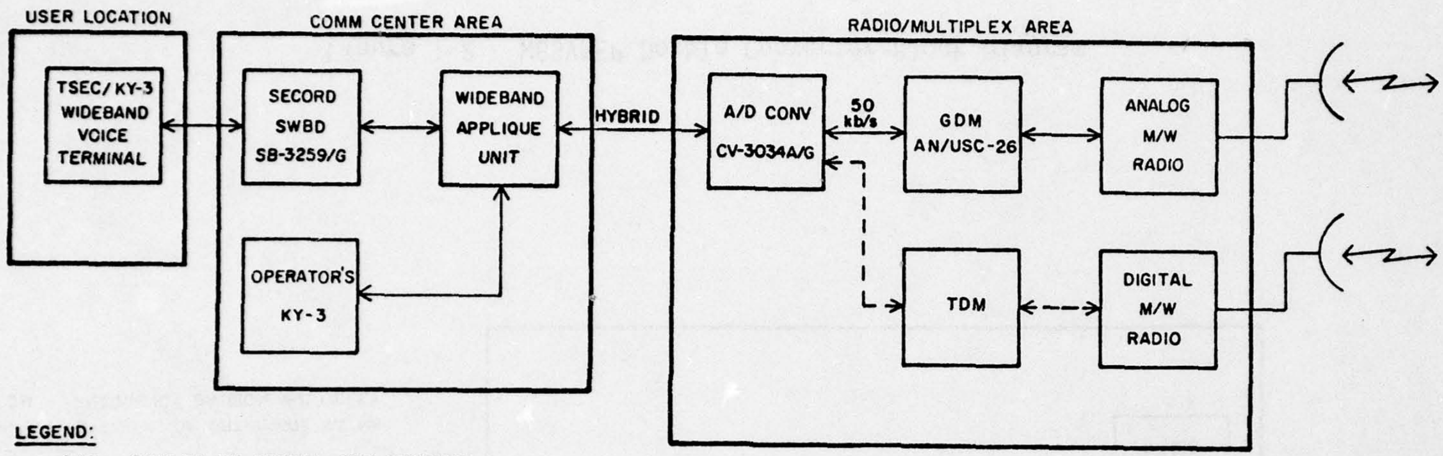
1.1 PURPOSE. The purpose of this Standard Engineering Installation Package (SEIP) is to provide detailed guidance for engineering, installing, and testing secure voice terminal/switching equipment for Wideband (50 kb/s) Secure Voice Network Extension Project (WBSVNEP).

1.2 SCOPE. The SEIP is applicable to all US Army Communications Command (USACC) engineering-installation (E-I) activities involved in the planning and implementation of extensions of the wideband secure voice network. It may be used by other Department of Defense Activities and US Government Agencies. RED/BLACK criteria have not been covered in this document. See MIL-HDBK-232 for details.

1.3 SYSTEM DESCRIPTION. The Wideband Secure Voice Network Extension Project provides improvement to the existing AUTOSEVOCOM network through implementation of wideband (50 kb/s) secure voice trunking between automatic and manual AUTOSEVOCOM wideband switching facilities, and extension of wideband secure voice service to certain subscriber locations. Specifically, this document provides E-I data for wideband AUTOSEVOCOM improvements consisting of necessary analog-to-digital converters, multiplex equipment, modems, and SECORD applique unit required to interface the secure voice circuits to wideband terminal/switching equipment to satellite and terrestrial transmission media. Either the SECORD switchboard SB-3259/G, electronic switches AN/FTC-31, or the Western Electric Company (WECO) 758C may be used as switching equipment. The link between user terminals/switches and terrestrial terminals may be by microwave channels or cable circuits. Three typical equipment configurations are shown. Two methods of interfacing subscribers to a microwave transmission medium are shown in figures 1-1 and 1-2. The satellite earth terminal extension for either of these configurations is shown in figure 1-3. All three configurations use combinations of the equipment listed in table 2-1.

1.3.1 Figure 1-1. In the first configuration, a single analog-to-digital (A/D) converter (CV-3034A/G) converts the analog or hybrid-analog input signal to a 50-kb/s data signal. This 50-kb/s signal is then fed into the AN/USC-26 group data modem (GDM). The GDM output is a signal in the range of 60 to 108 kHz (full group) or 72 to 96 kHz (half group), which is fed into the group modulator of the multiplex system.

1.3.2 Figure 1-2. In the second configuration, two A/D converters are used to provide input to an AN/GSC-24(V) multiplexer set.



LEGEND:

A/D - ANALOG-TO-DIGITAL AND REVERSE
HYBRID - DIGITAL DATA OR VF SIGNALS
GDM - GROUP DATA MODEM
TDM - TIME DIVISION MULTIPLEX
M/W - MICROWAVE
SWBD - SWITCHBOARD

NOTE: THE SECORD/WIDEBAND APPLIQUE COMBINATION IS DEPICTED HERE. THE SINGLE CONVERTER MAY ALSO BE USED WITH THE WECO 758C OR AN/FTC-31 ELECTRONIC SWITCHES SHOWN IN FIGURE 1-2. THE DOUBLE CONVERTER MAY ALSO BE USED WITH THE SECORD/WIDEBAND APPLIQUE COMBINATION.

Figure 1-1. WBSVNEP Single Converter Block Diagram.

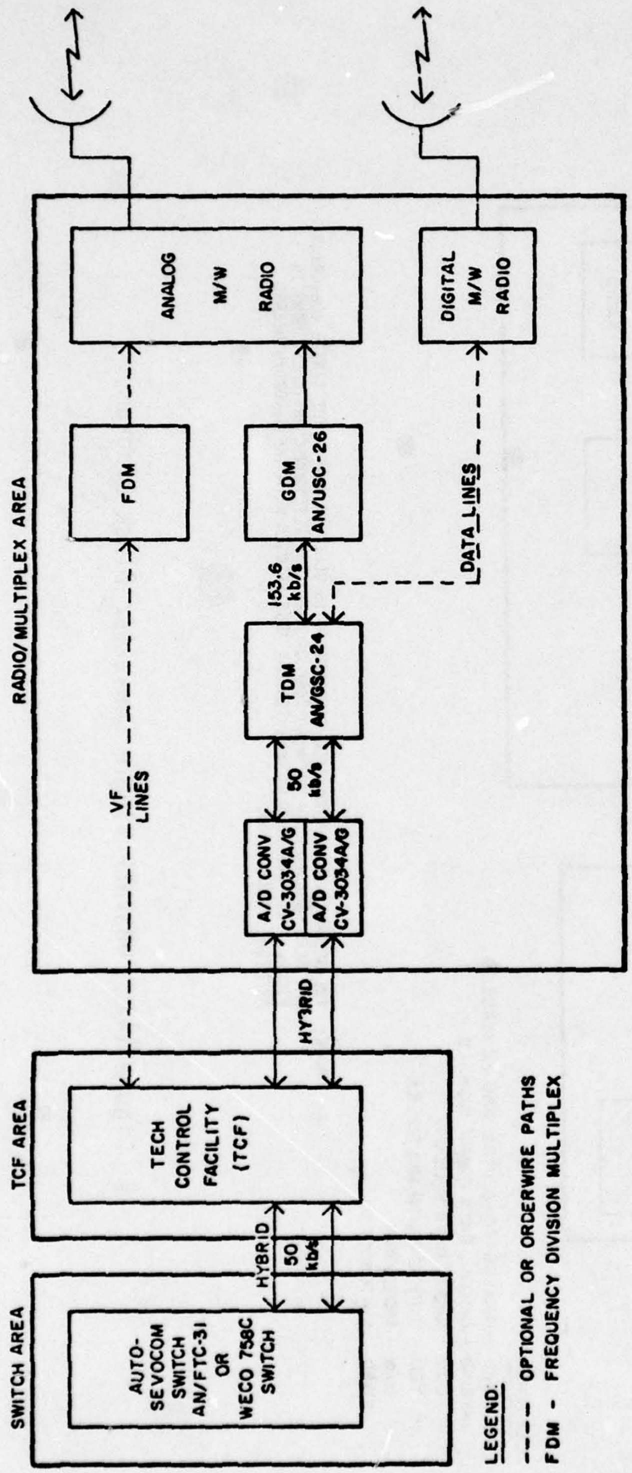


Figure 1-2. WBSVNEP Double Converter Block Diagram.

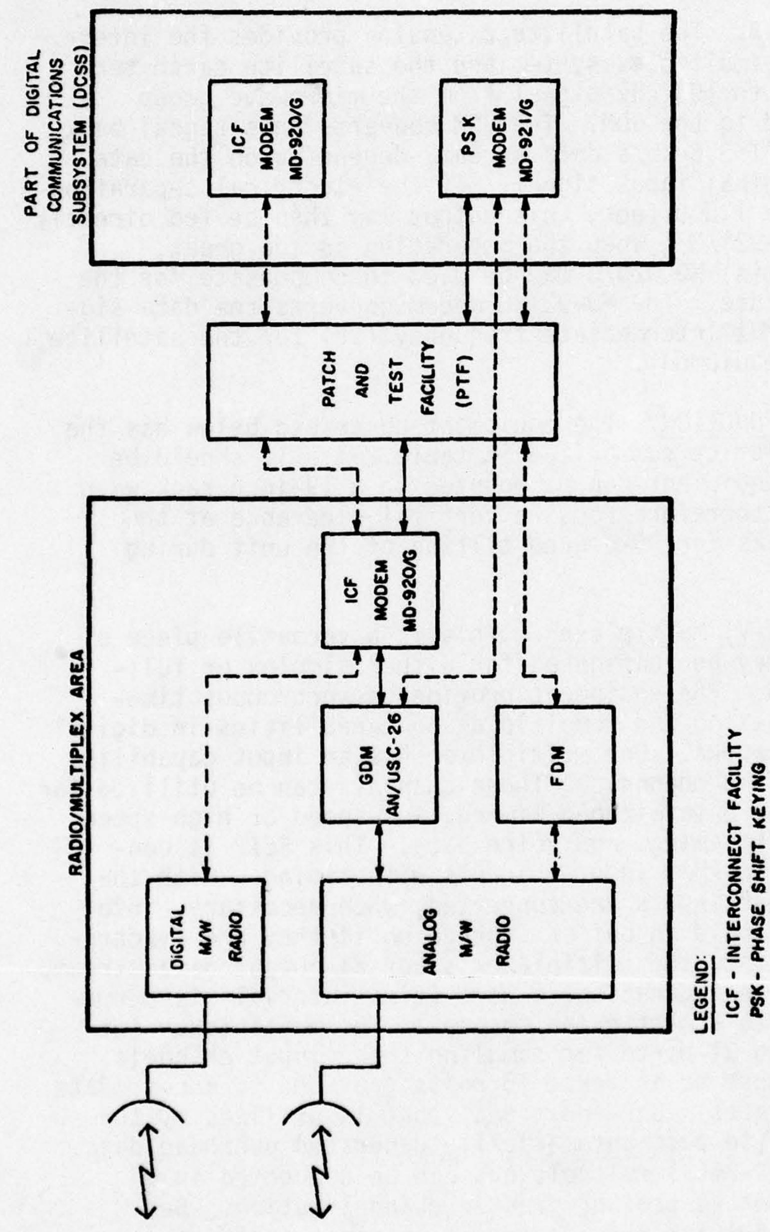


Figure 1-3. WBSVNEP Earth Terminal Block Diagram.

The multiplexer combines these two inputs with the overhead channel into a single 153.6-kb/s data stream that is then fed into the GDM. The 60- to 108-kHz (full group) output of the GDM is fed into the group modulator of the multiplex system.

1.3.3 Figure 1-3. The satellite extension provides the interface between the multiplex system and the satellite earth terminal. The 60- to 108-kHz signal from the microwave group modulator is fed to the GDM. The GDM converts this signal back into a 50- or a 153.6-kb/s data stream, depending on the data rate of the original input signal. If the electrical separation is not more than 1,000 feet, this output may then be fed directly to the modem MD-921/G. When the separation is too great, additional modem(s) MD-920/G may be used to compensate for the additional distance. The MD-921/G modem converts the data signals into a 70-MHz intermediate frequency (IF) for the satellite earth terminal equipment.

1.4 EQUIPMENT FUNCTION. The equipment described below has the basic characteristics summarized in table 2-1. It should be noted that all equipment can be mounted in a 19-inch rack with slides and will therefore require vertical clearance at the front of the racks for 90-degree tilting of the unit during service.

1.4.1 AN/GSC-24(V) Multiplexer. This is a versatile piece of equipment that may be configured for either simplex or full-duplex operation. The equipment provides asynchronous time-division multiplexing and demultiplexing capabilities in digital transmission networks. One multiplexer has an input capability of up to 15 traffic channels. These channels can be utilized for low-speed digital data without timing, low-speed or high-speed digital data with timing, and voice data. This SEIP is concerned with two 50-kb/s input channels with timing. With the proper card, these inputs are converted, when necessary, into digital form and held in buffer storage until they are synchronously inserted into the multiplexer's serial output data stream. In a particular configuration, a port (time interval) is permanently assigned to a particular channel. The multiplexer set can utilize up to 31 ports for sampling these input channels. However, there must be at least 15 ports provided to accommodate different data rates. One additional port is utilized by the equipment itself to pass automatically generated overhead data. Additional AN/GSC-24(V) multiplexers can be connected in a tandem arrangement to provide greater channelization. See TM 11-5805-688-14-1 for service and maintenance instructions on the AN/GSC-24(V) multiplexer set and TM 11-5805-688-14-2 for circuit diagrams on the equipment.

1.4.2 AN/USC-26 Group Data Modem. This modem consists of a transmitter, receiver, and power supply. The GDM provides transmission of synchronous, serial data over standard military group bandwidth transmission links and throughout the Defense Communications System (DCS). The GDM accepts input data rates of 19.2, 38.4, 50.0, 76.8, 115.2, or 153.6 kb/s and provides the necessary frequency translation to establish a compatible 60- to 108-kHz interface between frequency division multiplex (FDM) transmission link carrier equipment and high-speed data terminal equipment. Of these six input rates, only two (115.2 and 153.6 kb/s) will support the two 50-kb/s channels from the AN/GSC-24(V) multiplexer. Single-sideband pulse amplitude modulation (PAM) is employed by the equipment with Class IV partial response signal shaping. In the normal mode of operation, two different configurations (full group and half group) provide completely independent full-duplex operation. In the full-group (wideband) configuration, the equipment operates on any of the above data rates. In the half-group configuration, only data rates of 19.2, 38.4, 50.0, or 76.8 kb/s are possible because of the narrower bandwidth. This reduced bandwidth covers only the center six FDM voice channel slots (72 to 96 kHz). The half-group configuration leaves the outer six FDM voice channels available for normal voice operation. See TM 11-5805-692-14 for combined operation and maintenance instructions on the AN/USC-26 digital data modem.

1.4.3 CV-3034A/G A/D Converter. This unit interfaces full-duplex hybrid inputs with digital communications subsystems of the Defense Satellite Communications System (DSCS). A hybrid input may be either an analog or a digital signal. Typical digital interface applications are with a time division multiplexer (TDM) or a phase shift keying (PSK) or interconnect facility (ICF) modem. The transmitter has three selectable modes of operation: low-level voice, high-level voice, or hybrid. Input signals may be 3-kHz voice band (analog) or hybrid signals from a wideband switch or secure device. For hybrid inputs the transmitter detects whether the signal is analog or digital and processes it accordingly. The output digital data and clock signals are supplied by the transmitter for transmission to the far-end receiver. The receiver accepts the input digital data, automatically determines whether the original data was analog or digital, and converts it back to the original format. In most installations the clock is supplied with the digital data to the receiver. If the clock input is not provided, timing may be derived from the received data by changing the strapping in accordance with TM 11-5895-797-14. Each section of the converter can operate independently of the other.

1.4.4 MD-920/G Digital Data Modem. This equipment interfaces between the ICF and a remotely located satellite communications terminal. The ICF modem (MD-920/G) converts baseband data signals into the signal format required for transmission via the interconnect facility link. The ICF modem transmitter accepts the AN/GSC-24(V) normal output, which are nonreturn-to-zero (NRZ) data signals, and converts them into a bipolar form. These data may be at any rate between 19.2 kb/s and 5.0 Mb/s. At the earth terminal, these bipolar signals are fed into the MD-921/G modem or another MD-920/G receiver. The independent transmit and receive sections of the equipment provide full-duplex digital communications. Even the transmit and receive data rates are independently selectable. Equalization networks are provided in the receiver to compensate for phase distortion resulting from ICF cable links. See TM 11-5820-804-12 for instructions on adjusting these equalization networks.

1.4.5 MD-921/G Digital Data Modem. This modem interfaces between the satellite ground terminal and baseband data signals required by a digital user. The transmitter output is a biphase-modulated, PSK signal with a 70-MHz center frequency. This modulated 70-MHz output signal is compatible with the following earth terminal equipments:

AN/FSC-78
AN/MSC-46
AN/MSC-61
AN/TSC-54

The interface may be directly with a local user or via an ICF to the remote user. The PSK modem's MIL-STD-188 connections are used for the local data user and either cable or line-of-sight (LOS) microwave connections are provided for the remote user. Cable connections for 50- or 75-ohm coaxial or 75-ohm twinaxial cable are provided as cable options. The MD-920/G ICF modem must be provided at the remote data user's end for both cable and LOS systems. Any data rate between 19.2 kb/s and 5.0 Mb/s (error-correcting coding) or 9.9999 Mb/s (no error-correcting coding) may be processed by the PSK modem. See TM 11-5820-803-12 for modem adjustments and cable length requirements.

1.4.6 SECORD Wideband Trunk Applique Unit. This unit provides an interface between the SB-3259/G SECORD switchboard and the distant-end equipment of a wideband trunk. The distant-end equipment may be an AN/FTC-31 automatic secure voice communications (AUTOSEVOCOM) switch, WECO 758C switch, or another applique unit. The applique unit provides the indications for signaling, preemption, and subscriber status necessary for normal supervisory functions. The unit will permit up to three of the SECORD's

five trunks to be interfaced with wideband trunks. If more than three wideband trunks are required, another applique unit may be paralleled for these trunks. Any or all of the SECORD trunks not utilized in the wideband application may be employed in their normal narrowband application. The signaling employed by the applique unit may be either a 1000-Hz ring tone or a 2600-Hz idle channel tone. The preempt tones employed may be either 800 Hz or 620/440 Hz. Both of the above options are strap-selectable on a trunk-by-trunk basis. The trunk status is determined by monitoring the 50-kb/s signal on the receive line. See TM 11-5805-486-15 for information on the operation of the SECORD switchboard.

1.5 APPLICABLE DOCUMENTS.

a. Manuals

FM 11-487-4	Installation Practices: Communications Systems Grounding, Bonding, and Shielding
TM 11-5805-486-15	Operator's, Organizational, Direct Support, and General Support Maintenance Manual, Switchboard SB-3259/G
TM 11-5805-688-14-1	Service and Maintenance Instructions, AN/GSC-24(V) Multiplexer Set
TM 11-5805-688-14-2	Circuit Diagrams, AN/GSC-24(V) Multiplexer Set
TM 11-5805-692-14	Combined Operation and Maintenance Instructions Manual with Illustrated Parts Breakdown, Modem, Digital Data, AN/USC-26
TM 11-5820-803-12	Operator's and Organizational Maintenance Manual, Modem, Digital Data, MD-921/G
TM 11-5820-804-12	Operator's and Organizational Maintenance Manual, Modem, Digital Data, MD-920/G

TM 11-5895-797-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual, Analog-Digital Converter CV-3034A/G
USAF T.O. 31-10 Series	Standard Installation Practices

b. Regulations

CCR 702-1-2	USACC Quality Assurance Program for Engineering, Installation, and Acceptance of Communications-Electronics Equipment and Systems
CCCR 34-2	Preparation of Engineering Installation Packages and Standard Engineering Installation Packages
CCCR 34-3	Standardization Engineering Drawings
CCCR 702-1	USACEEIA Quality Assurance and Testing Program
CCCR 702-2	Preparation of Documentation for Test and Evaluation of Communications-Electronics Materiel
CCCR 702-3	Role of the Test Director

c. Military Standards and Handbooks

MIL-STD-188-124	Grounding, Bonding, and Shielding
(C) MIL-HDBK-232	RED/BLACK Engineering and Installation Guidelines (U)

d. Circulars

DCAC 370-160-3	Site Survey Data Book for Communications Facilities

1.6 COMMENTS ON PUBLICATION.

a. Users of this publication are invited to submit recommendations for its improvement. Comments should be keyed to the drawing, page, paragraph, and line of the text for which the change is recommended. A mailing card for convenience is bound with this SEIP. Comments should be sent directly to the Commander, US Army Communications-Electronics Engineering Installation Agency, ATTN: CCC-CED-SEP, Fort Huachuca, Arizona 85613.

b. Requests for USACEEIA regulations and forms should be addressed to the Commander, USACEEIA, ATTN: CCC-SPT-RM, Fort Huachuca, Arizona 85613.

SECTION 2. SITE SURVEY AND DATA CHECKLIST

2.1 GENERAL. This section provides the information necessary to accomplish preliminary engineering, equipment layout, and arrangements pertinent to the installation of Wideband Secure Voice Network Extension Project (WBSVNEP) equipment.

2.2 SITE SURVEY CRITERIA. Adequate current information may be available at the responsible area electronics engineering installation agency. If this information is sufficient to perform detail engineering, then no site survey may be necessary. If a site survey is required, it should be conducted in accordance with the following criteria:

a. Applicable portions of CCCR 34-2, Preparation of Engineering Installation Packages and Standard Engineering Installation Packages.

b. The criteria set forth in DCAC 370-160-3, Site Survey Data Book for Communications Facilities.

2.2.1 Site Survey Checklist. The site survey checklist (figure 2-1) should be used as a guide by the survey team for identifying and assembling the required technical data during the site survey.

2.2.2 Use of Site Survey Checklist. The checklist, when completed, will aid in preparing an official site survey report with equipment layout drawings. The site survey report will be an inclosure to the project coordination letter which must be forwarded through the responsible agencies for concurrence or nonconcurrence, plus any comments.

2.3 EQUIPMENT CHARACTERISTICS. The physical and electrical characteristics of the applicable equipments are listed in table 2-1. This table should be used to determine the site's physical size, ac power requirements, floor loading criteria, and additional heat dissipation. The interface requirements for this equipment are included in table 2-2. This table should be used to determine the equipment input/output requirements, including the stock number for the cable connector.

Table 2-1. WBSVNEP Equipment Characteristics

Equipment	Size*	Ambient operating range	Heat dissipation, Btu/h	Power input	Access clearance	Weight, lb
AN/GSC-24(V)	Height 24.5 in (62.23 cm) Depth 19.0 in (48.26 cm)	-18° to +52°C (0° to +125°F)	2164	115 V ac ± 10% Single phase 47 to 410 Hz 634 W	Front 48 in (121.92 cm) Rear 24 in (60.96 cm)	140
AN/USC-26	Height 15.72 in (39.93 cm) Depth 23.12 in (58.72 cm)	0° to +52°C (32° to +125°F)	1024	104 to 126 V rms Single phase 300 W	Front 39 in (99.06 cm)	90
CV-3034A/G	Height 3.5 in (8.89 cm) Depth 19.0 in (48.26 cm)	0° to +50°C (32° to +122°F)	102	120 ± 12 V ac Single phase 45 to 420 Hz 30 W	Front 38 in (96.52 cm)	19
MD-920/G	Height 12.25 in (31.12 cm) Depth 22.0 in (55.88 cm)	0° to +49°C (32° to +120°F)	1024	120 V ac ± 10% Single phase 45 to 420 Hz 300 W	Front 48 in (121.92 cm)	60
MD-921/G	Height 12.25 in (31.12 cm) Depth 22.0 in (55.88 cm)	0° to +49°C (32° to +120°F)	1707	120 V ac ± 10% Single phase 45 to 420 Hz 500 W	Front 48 in (121.92 cm)	80

*Each of these fits a standard 19-inch rack mounting with slides.

Table 2-2. WBSVNEP Interface Requirements

Equipment	Input impedance	Connector Function	Connector Symbol	Interfacing cable connector	Output impedance	Connector Function	Connector Symbol	Interfacing cable connector
AN/GSC-24(V) mux	75 ohms	Timing	J1 to J29 Odd	5935-01-018-1713 (21545G)	75 ohms	Timing	J61	5935-01-018-1713 (21545G)
		Data	J2 to J30 Even	5935-01-018-1713 (21545G)		Data	J62	5935-01-018-1713 (21545G)
AN/GSC-24(V) demux	75 ohms	Timing	J64	5935-01-018-1713 (21545G)	75 ohms	Timing	J31 to J59 Odd	5935-01-018-1713 (21545G)
		Data	J65	5935-01-018-1713 (21545G)		Data	J32 to J60 Even	5935-01-018-1713 (21545G)
AN/USC-26 xmt	75 ohms	Timing and Data	J9	5935-00-439-3748 (19689J)	75 ohms	Timing	J6	5935-00-916-5400 (19690J)
					75 ohms unbal 135/150 ohms bal	Data		
AN/USC-26 rcv	75 ohms unbal 135/150 ohms bal	Data	J6	5935-00-916-5400 (19690J)	75/100 ohms	Timing and Data	J9	5935-00-439-3748 (19689J)
CV-3034A/G xmt	135 ohms bal	Hybrid Data	J3	5935-00-223-2821 (19687L)	75 ohms bal	Timing	J4	5935-01-018-1713 (21545G)
						Data	J5	
CV-3034A/G rcv	75 ohms	Timing	J7	5935-01-018-1713 (21545G)	135 ohms bal	Hybrid Data	J9	5935-00-223-2821 (19687L)
		Data	J8					
MD-920/G xmt	75 ohms bal	Data	J5	5935-00-905-3949 (19691X)	75 ohms bal	Timing and Data	J5	5935-00-905-3949 (19691X)
MD-920/G rcv	75 ohms bal	Timing and Data	J5	5935-00-905-3949 (19691X)	75 ohms bal	Data	J5	5935-00-905-3949 (19691X)
MD-921/G xmt	75 ohms bal	Data	J5	5935-00-905-3949 (19691X)	75 ohms bal	Timing and Data	J5	5935-00-905-3949 (19691X)
MD-921/G rcv	75 ohms bal	Timing and Data	J5	5935-00-905-3949 (19691X)	75 ohms bal	Data	J5	5935-00-905-3949 (19691X)

SITE SURVEY CHECKLIST
FOR

____

____

____

____

DATE: ____

PROJECT NUMBER: ______________________________________

SITE LOCATION: _______________________________________

CITY: ____________________ COUNTRY: __________________

INSTALLATION: ____

BUILDING: ________________ ROOM: _____________________

PROJECT ENGINEER: ____________________________________

____

____

CLASSIFICATION: ______________________________________

SAMPLE

Figure 2-1. Sample Site Survey Checklist.

PROJECT OR TASK NO: ____

1. PURPOSE OF SITE SURVEY: ____________________________________

____

____

____

____

2. PERSONNEL CONTACTED OR PRESENT DURING SURVEY:

Name, Grade, and Title	Organization	Phone No.
a.		
b.		
c.		
d.		
e.		
f.		
g.		
h.		

3. EQUIPMENT TO BE INSTALLED:

   a. Contractor furnished and installed.

   b. GFE, Government installed.

   c. GFE, contractor installed.

   d. Equipment description chart.

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO: ______________________________

Nomenclature	Weight	Dimensions	Ambient operating ranges	Heat dissipation	Access clear. rqmts

4. DOCUMENTATION:

a. Documentation of the status of the physical plant should be completed by requisition and review of the appropriate as-built drawings. The list of as-built drawings obtained is as follows:

Drawing No.	Title	Revision date	Source

b. Drawings not available during the site survey should be requested by local military authorities through channels. Once obtained, the drawings should be forwarded to the responsible area electronics engineering installation agency.

c. If as-built drawings of the physical plant are not available, lack sufficient details, or are inadequate, provide a dimensioned sketch of the floor plan including location, dimensions, and identity of each equipment. (Attach sketch.)

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO: ____________________

d. Additional general information bearing on the engineering of the facility is as follows:

____

____

____

____

____

____

____

5. ROOM CONFIGURATION (to be supported by scaled drawings):

a. Floor:

(1) Material: ____________________

(2) Condition: ____________________

(3) Loading capacity: ____________________

(4) Obstructions: ____________________

____

____

____

____

(5) Space available under raised flooring, if installed:

____

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO: ____________________

b. Ceiling:

(1) Material: ____________________

(2) Condition: ____________________

(3) Height (suspended or other): ____________________

(4) Obstructions: ____________________

____

____

(5) Space available for ducting if a drop ceiling is installed: ____________________

____

c. Environmental systems:

(1) Type of heating: ____________________

Btu/h capacity: ____________________

(2) Type of air conditioning: ____________________

Btu/h capacity: ____________________

(3) Maximum number of personnel who normally occupy area: ______

(4) Humidity controlled: Yes___No___

(5) Heat dissipation capacity of existing equipment: ______

____________________Btu/h

(6) Surplus air-conditioning capacity available for this installation: ____________________Btu/h

(7) Feasibility of expansion (if necessary): ____________

(8) Monitoring equipment: ____________________

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO:__________________________________

6. POWER AVAILABILITY:

a. Primary power supplied by commercial means: Yes___No__

b. Power specifications:

(1) Present available capacity:________________________kW

(2) Voltage:___________________________________volts

(3) Frequency:___________________________________Hz

(4) Phase:______________________________________Ø

(5) Size of feeder lines:________________________AWG

(6) Monitoring equipment (if any):__________________

c. Means of providing emergency power:

(1) Manual start, automatic start, or no-break:__________

(2) Manual or automatic switching unit:_______________

(3) Emergency power available:______________________

(4) Generator specifications:

Number	Rating (kW)	Frequency (Hz)	Nomenclature	Capacity (kW)

d. Space available for additional generators: Yes___No___

Figure 2-1. Sample Site Survey Checklist (Continued).

SAMPLE

PROJECT OR TASK NO: ______________________________

e. Uninterrupted power requirements: Yes___ No___

(1) Voltage: ______________________________

(2) Current: ______________________________

(3) Solid-state system: Yes___ No___

Life after power failure: ______________________________

Type of battery: ______________________________

f. Presently programed power upgrade (give details): ______

____

SAMPLE

g. Technical load:

(1) Present critical technical load: ______________ kW

(2) Present noncritical technical load: ______________ kW

(3) Present nontechnical load: ______________ kW

7. EXISTING POWER CONFIGURATION:

Main power panel:

(1) Location: ______________________________

(2) Rating: ______________________________ kVA

(3) Voltage: ______________________________ volts

(4) Phase: ______________________________ Ø

(5) Frequency: ______________________________ Hz

(6) Number of spare circuit breakers: ______________

(7) RED/BLACK TEMPEST: ______________________________

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO:______________________________

8. STATION GROUND:

a. Signal ground installed: Yes__ No__

(1) Type:______________________________

(2) Resistance of true earth ground:____________ohms

(3) Date measured:______________________________

(4) Method used:______________________________

(5) RED/BLACK ground distribution boxes available for installation: Yes___ No___

b. Protective ac ground installed: Yes___ No___

(1) All equipment grounded to ac protective ground by separate wires: Yes___ No___

(2) Ferrous shields tied to ac protective ground bus: Yes___ No___

9. PRESENTLY INSTALLED EQUIPMENT: (List type and quantity of installed equipment that will be associated with or used for this installation.)

Item No.	Room location	Nomenclature	Qty in operation	Qty reserved

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO: ______

10. MISCELLANEOUS: ______

a. Rack face elevations:

(1) Mounting space: ______

(2) Patch panels: ______

(3) Alarm panels: ______

b. Cable runs:

(1) Cable tray/rack details: ______

(2) Lengths: ______

(3) Run 78-ohm cable to: ______

(4) Run 124-ohm cable to: ______

(5) Types of connectors: ______

c. Combined distributing frames:

(1) Vertical side location: ______

(2) Horizontal side location: ______

(3) Type of blocks: ______

(4) Block designation: ______

(5) For wideband applique installation, check associated SECORD terminations.

d. Microwave/satellite channel-slot allocation: ______

e. Timing:

(1) Internal: ______

(2) External: ______

Figure 2-1. Sample Site Survey Checklist (Continued).

PROJECT OR TASK NO: ____________________

f. Material:

(1) Shipment destination: ____________________

(2) Storage: ____________________

(3) Disposition: ____________________

____
Site Survey Team Chief

Figure 2-1. Sample Site Survey Checklist (Continued).

SECTION 3. INSTALLATION SPECIFICATIONS AND INSTRUCTIONS

3.1 INTRODUCTION. This section provides standard engineering and installation guidance for the equipment used on WBSVNEPs. No attempt has been made to duplicate specific detailed instructions from individual equipment technical manuals. The specific technical manual on each individual piece of equipment is listed in paragraph 1-5 and should be consulted when that particular equipment is installed.

3.2 GENERAL INSTRUCTIONS. The equipment will be installed in accordance with established criteria, the engineering drawings and instructions, and referenced drawings and publications deemed necessary by the responsible engineering activity. Installation personnel must be familiar with the T.O. 31-10 Series, Standard Installation Practices, as applicable, to ensure that the facility is installed in accordance with standard installation procedures.

3.2.1 Sequence of Installation. The following sequential steps provide an outline to be used by the engineer to develop the final Engineering Installation Package (EIP). Changes to this sequence of installation procedures may be made by the engineer as required. Latitude for making minor deviations from the EIP may be delegated to the Installation Team Chief. In this aspect, "minor" is defined as a change which affects the method or sequence of performing an operation or function but which will not affect any other phase of that project. As a minimum, these changes or deviations will not (1) cause BOM shortages, (2) alter the floor plan, (3) extend the completion date, or (4) increase manpower or funding requirements.

3.2.1.1 Inventory. Using the project BOM as a checklist, inventory all equipment and installation material. During the inventory, inspect all items for damage and make any necessary reports. Be cautious of substitute items, and ensure that they will perform the same function as the original item.

3.2.1.2 Physical location. Using the floor plan provided in the EIP, physically locate all existing equipment and ensure that the actual layout agrees with the plan. At the same time, determine the proposed locations for the equipment to the installed. This includes bay locations, frame blocks, cable trays, patch panels, and jack assignments. Discuss any differences with the O&M command to obtain the background for the project engineer. Contact the project engineer and make him aware of these differences and the background obtained from O&M personnel.

3.2.1.3 Preliminary effort. Perform all preliminary installation work in preparation for major item installation. Install major assembly items such as racks, frames, and cable trays.

3.2.1.4 Grounding. Install ground wires to equipment where required. Ensure good metal-to-metal contact and that the completed installation meets the standards established by MIL-STD-188-124 and FM 11-487-4.

3.2.1.5 Power cabling. Make all cable runs for power service in accordance with the applicable T.O. Runs shall be measured to ensure that sufficient cable is cut. CAUTION: For safety, do not connect to the source until the installation is complete and ready for power service. In the event the runs are fused, the connection may be accomplished and the fuse removed to prevent power application to the equipment.

3.2.1.6 Signal cabling. Make signal cable runs and lay cables in accordance with the EIP. Measure and cut signal cables. NOTE: Use caution to ensure that there is no excessive waste.

a. Connectors. Affix connectors to one end of the cable; however, the other end shall be left unterminated until the cables are placed in the final configuration and slack is removed from the runs.

b. Cable dress. Working toward the unterminated end, dress out cable runs and remove all unnecessary slack. Affix the remaining connectors and terminate as required.

c. Marking and stenciling. All blocks and cable terminations shall be marked and stenciled in accordance with the EIP. This effort may be accomplished at any time during the installation effort; however, it should be accomplished prior to cable termination. Mark and stencil equipment in accordance with the EIP.

3.2.1.7 Verification. Verify assignments and cabling connections. Recheck all wiring and connections to ensure proper termination and absence of shorts, reversals, and opens.

3.2.1.8 Power termination. Make the final power termination to the power source. For fused service, this may be accomplished by installing the fuse in the appropriate location.

3.2.1.9 Initial settings. Adjust initial settings on the equipment in accordance with the manufacturer's instructions and the EIP. NOTE: Observe all precautions. Many equipment failures occur during the initial turn-on, because of wiring faults, incor-

rect procedures, improper initial settings, and concealed faults or damage. Initial settings for this application are provided in table 3-1 for the AN/GSC-24(V) and table 3-2 for the AN/USC-26. The CV-3034A/G strapping options for this application are--

a. Card 1A9, strap E1 to E2 (low-level voice).

b. Card 1A7, strap E1 to E2 (external clock).

3.2.2 Equipment Slide Mounting. This equipment can be installed in a standard 19-inch rack with or without slides. Slides are provided with all the equipment except the CV-3034A/G converter. The following criteria will be adhered to when using slides.

3.2.2.1 Anchoring. The rack will be securely anchored to prevent toppling when the equipment is extended on its slides. Consideration shall also be given to prevent damage during earthquakes.

3.2.2.2 Cable length. Additional cable length will be provided to allow for equipment operation and testing in the extended position.

3.2.2.3 Cable retractors. Retractors will be installed and the cable secured to the retractors.

3.2.2.4 Support assemblies. Chassis guide and support assemblies will be provided in installations where the equipment is subject to earthquakes or heavy vibration.

3.2.3 Cabinet Installation. Two types of cabinets are listed on the BOM; one is without sides and the other is equipped with both sides. The type to be used will depend on the location in the communications facility. If the new cabinet is to be adjacent to an existing row of equipment, there may be no need for additional side panels. Make sure that the old side panel will fit the new cabinet. (This is a possible site survey checklist item.) If the new installation will become an equipment row, two side panels will be needed. Make the equipment foundation and mount the cabinet in accordance with the EIP drawing.

3.2.4 Cabling. All cables shall be tagged in accordance with the wire run lists and the applicable T.O. Cabling from the radio/multiplex to the wideband patch and from the subscriber equipment to the WBSVNEP patch panels will be determined on a case-by-case basis and added to the site EIP BOM.

Table 3-1. AN/GSC-24(V) Strapping and Switch Conditions for Initial Setup

Multiplex				Demultiplex			
Card type and part number	Equipment slot	Switch designation	Switch position	Card type and part number	Equipment Slot	Switch designation	Switch position
RCB Card Part #61864010	1 thru 15	S-1 S-2	Ro > 2 kHz 1001011001	SB Card Part #61864090	1 thru 15	S-1 S-2	Ro > 2 kHz 1001011001
		S-3	URC			S-4	ON
		S-4 S-5	75 75			S-5 S-7	B range BCD range
		S-6 S-7	ON ON			S-8 S-9	B range Normal
RT Card Part #61864150	16	S-2A thru S-2C	B			S-10A & B S-11A & B S-12	N N B range
		S-2E S-3 S-5	BAL 0 INT			S-14 thru S-18	B
		S-7A thru S-7B	Normal			S-19 S-20 & 21	BAL B
		S-8A thru S-8D	B			S-22 S-23 S-24 & 25	BAL B B range
		S-8E	BAL				
OEG Card Part #61864020	19	S-1	Jumper to ON for active channels	OEG Card Part #61864020	19	S-1	Jumper to ON for active channels
SEQ Card Part #61864040	21	S-1 of ports 1, 12 and 23	Active	SEQ Card Part #61864040	21	S-1, S-12 and S-23	Active
		S-1 of ports 2 thru 11, 13 thru 22, & 24 thru 31	Strapped			S-1 of ports 2 thru 11, 13 thru 22, & 24 thru 31	Strapped
		S-2	11111			S-2	11111
GC/DM Card Part #61864030	20			GC/DM Card Part #61864030	20		

Table 3-1. AN/GSC-24(V) Strapping and Switch Conditions for Initial Setup (Continued)

Multiplex	Demultiplex			
	Card type and part number	Equipment slot	Switch designation	Switch position
	FS card Part #61864110	16	S-1 S-2 S-3A & S-3B S-4 & S-5	Normal data Normal timing N 75
	Error rate Detector Part #61864120	17	S-1	10^{-2} for error threshold
	Display card Part #61864050	22	S-1	N
	Thermal alarm Options Part #61861028	Front Panel Board A2A	Option #1 (See Note 1)	Strap E-24 & E-25
			Option #2 (See Note 2)	Remove strap E-24 & E-25

NOTES:

1. Option #1 - turns off equipment if temperature exceeds limits.
2. Option #2 - sets alarm but does not turn off equipment.

Table 3-2. AN/USC-26 Digital Data Modem Strapping Options

Option	Card Number	Strapping	Connections
Transmit Bandwidth Transmit PRG	A-5	Half Group Full Group Self Sync	E-3 to E-5 E-3 to E-6 No connection
Receive Bandwidth Receive PRG	A-21	Half Group Full Group Self Sync	E-2 to E-6 E-2 to E-5 No connection
Impedance Group Input	A-8	Balanced 135 ohms	E-10 to E-6 E-11 to E-7
Impedance Group Output	A-9	Balanced 135 ohms	E-19 to E-13 E-18 to E-14
Transmitter Decade		0 dB	E-20 to E-24
Transmitter Out Alternate		-5 dB	E-31 to E-36
Input data Impedance Clock Input Imped	A-6	Normal 75 ohms 75 ohms	None E-31 to E-32 E-29 to E-30
Transmitter Control Start Mode Auto Restart		ON AUTO FULL AUTO	E-8 to E-9 E-27 to E-28 No connection
RTS Polarity RTS Reference Voltage		Normal +6.2 V dc	No connection E-26 to E-25
CTS Delay Ready Inhibit Polarity		12-second delay Normal	E-5 to E-6 No connection
Timing Source External Reference External Clock Rate External Clock Input Polarity		External Clock Normal Normal	No connection No connection E-1 to E-2 No connection
Data Sampling Point		Normal	No connection

Table 3-2. AN/USC-26 Digital Data Modem
Strapping Options (Continued)

Option	Card number	Strapping connections		
		Normal	75 ohms	
TX Timing #1 Output	A-7	E-76 to E-72	E-77 to E-75	
TX Timing #2 Output		E-82 to E-78	E-83 to E-81	
Timing Sync		E-70 to E-66	E-71 to E-69	
		Normal	+6.2 V dc	Ground
Data In		E-9 to E-3	E-10 to E-6	E-11 to E-7
Timing/Data Phase Alarm		E-18 to E-12	E-19 to E-15	E-20 to E-16
TX Out Monitor		E-27 to E-21	E-28 to E-24	E-29 to E-25
DC Voltage Alarm		E-36 to E-30	E-37 to E-33	E-38 to E-34
Temperature Alarm		E-45 to E-39	E-46 to E-42	E-47 to E-43
TX Timing Alarm		E-54 to E-48	E-55 to E-51	E-56 to E-52
CTS Polarity		E-63 to E-57		
CTS Voltage			E-64 to E-60	E-65 to E-61
		Normal	75 ohms	
RX Timing #1 Output	A-19	E-76 to E-72	E-77 to E-75	
RX Timing #2 Output		E-82 to E-78	E-83 to E-81	
Receive Data		E-70 to E-66	E-71 to E-69	
		Normal	+6.2 V dc	Ground
Performance				
Monitor A		E-9 to E-3	E-10 to E-6	E-11 to E-7
Monitor B		E-18 to E-12	E-19 to E-15	E-20 to E-16
Receiver AGC		E-27 to E-21	E-28 to E-24	E-29 to E-25
Receiver Sync		E-36 to E-30	E-37 to E-33	E-38 to E-34
Receiver Output		E-45 to E-39	E-46 to E-42	E-47 to E-43
Receiver Timing Alarm		E-54 to E-48	E-55 to E-51	E-56 to E-52
Ready Polarity		E-63 to E-57		
Ready Voltage			E-64 to E-60	E-65 to E-61

3.3 DETAIL INSTRUCTIONS. The following installation instructions are keyed to the drawings provided in section 4.

3.3.1 Rack Placement and Mounting Details. Install the equipment racks in the location shown on the EIP floor plan. Assemble the racks as shown on drawing STD-MS-0017.

3.3.2 Cable Supports. Install the ducts, cable ladders, and conduits for the signal and power cables as shown in the site EIP.

3.3.3 Grounding. Install the station grounding network as shown in the site EIP. The grounding network shall comply with MIL-STD-188-124. Depending on the site grounding configuration, individual ground bars may be required in certain racks. Install these ground bars in the designated racks in accordance with drawing STD-MS-0017, sheet 4 of 8.

3.3.4 Ac Power. Install the ac power to the equipment and cabinet outlets in accordance with the site EIP ac power distribution drawings and ac power wire running lists. The equipment service shall be connected to the uninterruptible power supply (UPS) system if available. The convenience outlet shall be connected to the noncritical power source.

3.3.5 Signal Cables. Install the signal cables as shown on drawing STD-SV-0008, STD-SV-0009, or STD-SV-0010. Use TWC-124-2 twinaxial cable (BOM item 125) for 135-ohm cable runs and RG-108 A/U (BOM item 123) for 75-ohm cable runs. Equip cables with BJ-type, twinaxial-type connectors (BOM item 58) for termination at the equipment and patch panels. Refer to drawings STD-SV-0015 and STD-SV-0016 for connector locations.

3.3.6 Equipment Placement. Install the equipment in the equipment cabinets as shown on drawings STD-SV-0013 and STD-SV-0014. Patch panel layouts for the three system configurations are shown on drawings STD-SV-0011 and STD-SV-0012.

3.3.7 SECORD Wideband Trunk Applique Unit. For those sites scheduled to receive a SECORD wideband trunk applique unit, install and wire the unit in accordance with the following instructions and the site EIP.

a. Mount the unit in a standard 19-inch equipment rack that provides a rack space of 5-1/4 inches.

b. Secure the signal cable connectors supplied with the wideband applique unit and terminate cables in accordance with drawings STD-SV-0006 (sheet 2) and STD-SV-0017 and the cable running list provided in the site EIP.

c. Run the signal cables to the CDF and terminate them in accordance with the site EIP. NOTE: Ensure that the block terminations facilitate frame jumper connections to the SECORD switchboard which may already be installed. See drawing STD-SV-0017 to determine frame jumper requirements.

d. Ensure that switch setting or strap options for the applique unit are set in accordance with the manufacturers literature and the site EIP.

e. Perform the initial alignment adjustments in accordance with the manufacturers literature, section 7 of this SEIP, and the site EIP, when applicable.

f. Terminate the operator's KY-3 to the connector for trunk 1 only. NOTE: Requirements specified in MIL-HDBK-232 shall be observed for the KY-3 installation.

g. Connect the wideband applique unit to the power source (BLACK) that is used to supply power to the secure voice equipment.

SECTION 4. ENGINEERING INSTALLATION DRAWINGS

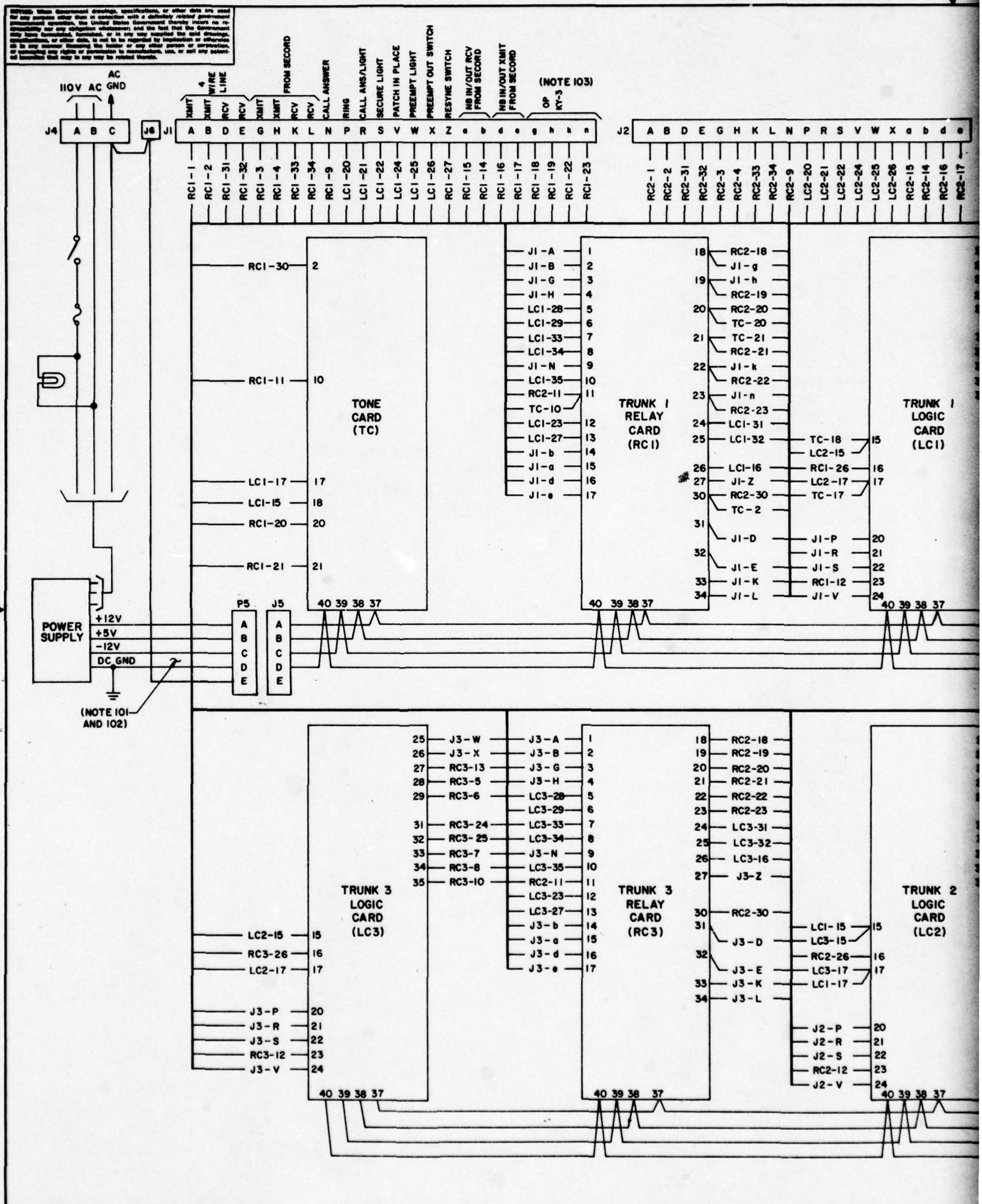
4.1 GENERAL. The engineering installation drawings contained in this section show typical interconnect diagrams, patch panel layouts, rack configurations, and equipment rack assembly details. Rear views of the equipment listed in table 2-1 are provided to assist in the preparation of engineering installation packages (EIPs) for specific projects.

4.2 MODIFICATION OF INSTALLATION DRAWINGS. The engineering drawings may be modified during and after the installation of a project to reflect changes. Drawing changes will be marked with color pencils as follows: red for additions, blue for engineering notes, and yellow for deletions. Copies of modified drawings will be retained at each site and will also be forwarded to the responsible area office of the C-E engineers for corrective action.

4.3 US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY DRAWINGS.

STD-SV-0004	SECORD Wideband Trunk Applique Unit Wiring
STD-SV-0005	SECORD Wideband Trunk Applique Unit Printed Circuit Card Dimensions
STD-SV-0006	SECORD Wideband Trunk Applique Unit Chassis (3 sheets)
STD-SV-0008	WBSVNEP Interconnect Diagram (Typical Single Converter)
STD-SV-0009	WBSVNEP Interconnect Diagram (Typical Dual Converter)
STD-SV-0010	WBSVNEP Interconnect Diagram (Typical Earth Terminal)
STD-SV-0011	WBSVNEP Patch Panel Layout (Single/Dual Converter Configurations (2 sheets)
STD-SV-0012	WBSVNEP Patch Panel Layout (Typical Earth Terminal)
STD-SV-0013	WBSVNEP Rack Face Elevations (Single/Dual Converter Configurations)

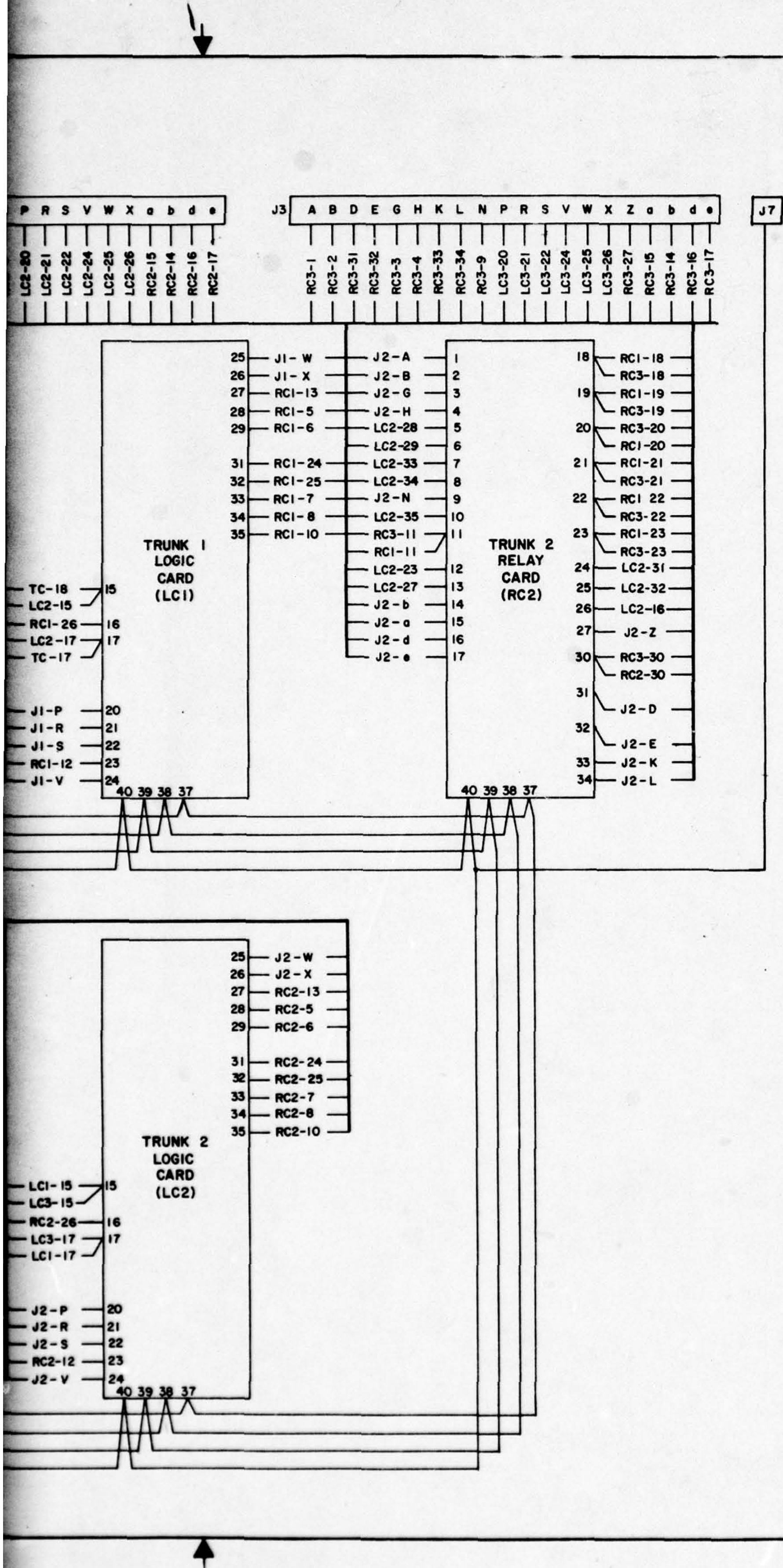
STD-SV-0014	WBSVNEP Rack Face Elevations (Typical Earth Terminal)
STD-SV-0015	WBSVNEP Converter and Multiplex Equipment
STD-SV-0016	WBSVNEP Modem Equipment
STD-SV-0017	WBSVNEP Wideband Secure Voice Applique Unit Interface
STD-MS-0017	Typical Equipment Rack Assembly Details (8 sheets)



110V AC
AC GND
J4
A B C
J6
J1
XMIT
XMIT
4 WIRE LINE
RCV
RCV
XMIT
XMIT
FROM SECORD
RCV
RCV
CALL ANSWER
RING
CALL ANS/LIGHT
SECURE LIGHT
PATCH IN PLACE
PREEMPT LIGHT
PREEMPT OUT SWITCH
RESYNC SWITCH
NB IN/OUT RCV FROM SECORD
NB IN/OUT XMIT FROM SECORD
(NOTE 103)
OP KY-3
J2
TONE CARD (TC)
TRUNK 1 RELAY CARD (RC1)
TRUNK 1 LOGIC CARD (LC1)
POWER SUPPLY
+12V
+5V
-12V
DC GND
P5
J5
(NOTE 101 AND 102)
TRUNK 3 LOGIC CARD (LC3)
TRUNK 3 RELAY CARD (RC3)
TRUNK 2 LOGIC CARD (LC2)

2

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		J6 AND J7 ADDED	10MAR77	a.a.a.
B		CIRCUITRY TO PIN 38 OF ALL RELAY CARDS ADDED & WIRING BETWEEN J4 & POWER SUPPLY CHANGED	12MAY77	a.a.a.
C		REVISED PER FIELD CORRECTIONS	26JUL77	a.a.a.
D		ADDED CIRCUITRY CONNECTIONS, CHANGED PIN CONNECTIONS, DELETED CIRCUITRY CONNECTIONS, AND CHANGE DWG. NO. FROM 00000SV10BM0002 SH 1 OF 1	20OCT77	a.I.H.



NOTES:

101. PINS C, F, J, M, T, U, Y, c, f, j, AND m OF THE J1 SOCKET ARE CONNECTED TO J5 PIN D.

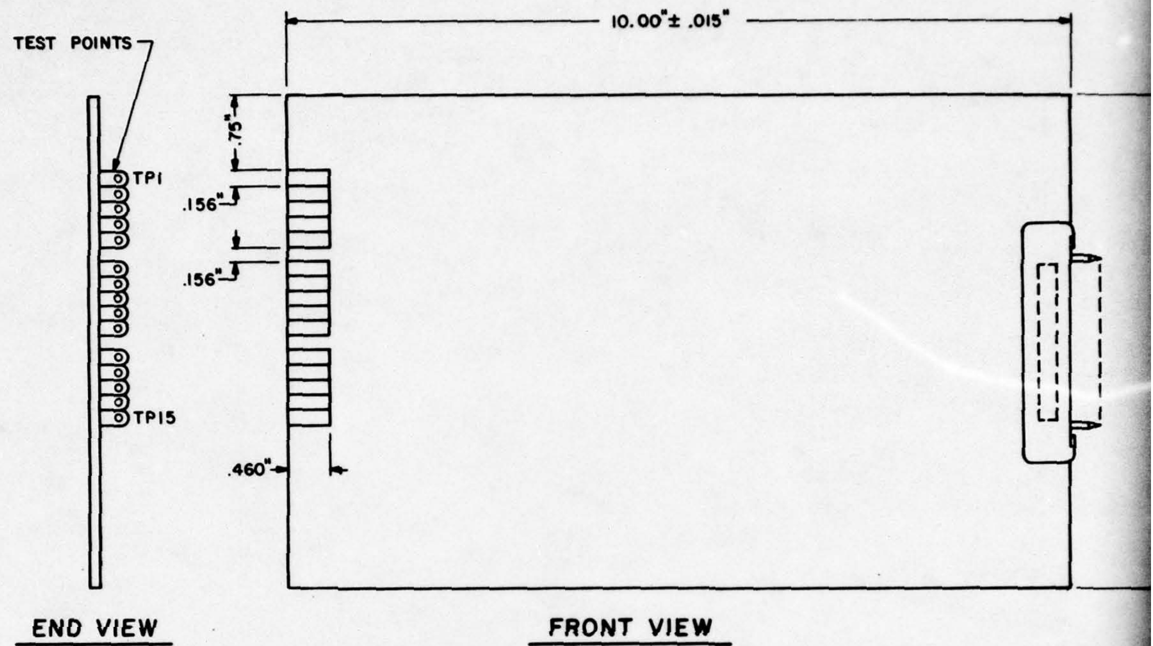
102. PINS C, F, J, M, T, U, Y, c, AND f OF J2 AND J3 ARE CONNECTED TO J5 PIN D.

103. OPERATOR KY-3 WILL BE CONNECTED TO PINS g, h, k, n OF CONNECTOR J-1 ONLY, ALL OTHER CONNECTIONS ARE COMMON FOR J1, J2, AND J3.

STD-SV-0004 SHEET 1 OF 1	ORGANIZATION USACEEIA-CED FORT HUACHUCA, ARIZONA
DESIGN BY OMARTIAN	SECORD WIDEBAND TRUNK APPLIQUE UNIT-WIRING
DRAFTSMAN J. WREN	
CHECKER D.R. Robb	
DATE 10 SEP 76	
ORGANIZATION APPROVAL N. D. Chorley	CODE IDENT NO. 50470 — SIZE D
CCC-CED-SWS	SCALE NONE — REVISION C — SHEET

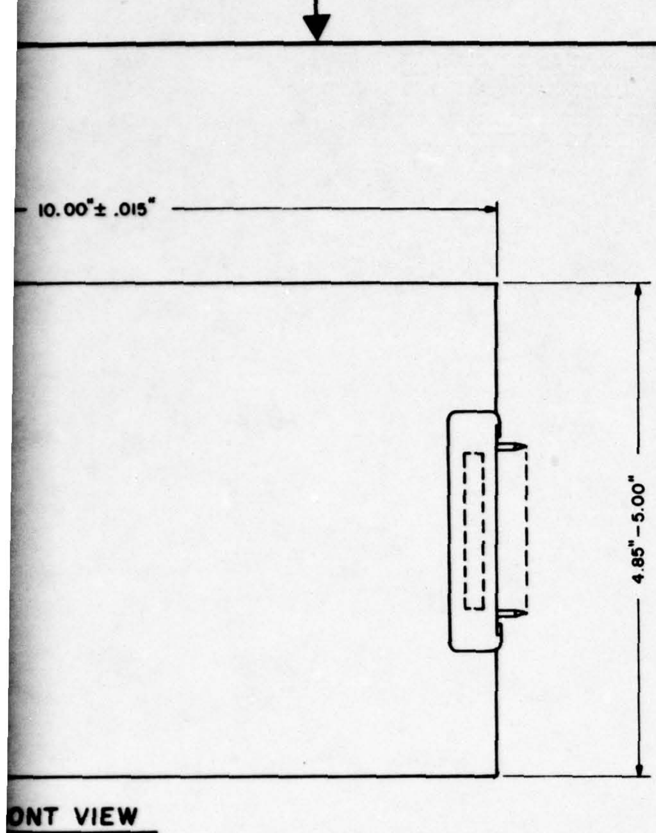
FORM 244727

ENTERED IN USACEEIA EDB C2-34-D1



TEST POINTS
TP1
TP15
10.00" ± .015"
.75"
.156"
.156"
.460"
END VIEW
FRONT VIEW

2



REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		EXTRACTOR HOLES REMOVED WIDTH TOLERANCE CHANGED & NOTE I ADDED	05/12/77	Q.A.O
B		NOTE CHANGE AND CARD DEMENSIONS CHANGE. CHANGE DWG. NO. FROM 00000SVIOBM0003 SH I OF I	20OCT77	RJH

NOTE

1. THE TONE CARD SHALL REQUIRE 14 TEST POINTS.
   THE RELAY CARD SHALL REQUIRE 15 TEST POINTS.
   THE LOGIC CARD SHALL REQUIRE 13 TEST POINTS.

ITEM	DESCRIPTION	FSN	UI	QTY

LIST OF MATERIALS

STD-SV-0005 SHEET 1 OF 1	ORGANIZATION: USACEEIA-CED FORT HUACHUCA, ARIZONA
DESIGN BY: OMARTIAN	SECORD WIDEBAND TRUNK APPLIQUE UNIT PRINTED CIRCUIT CARD DIMENSIONS
DRAFTSMAN: M. BOLLACK	
CHECKER: GR Robb	
DATE: 6 SEP 76	
ORGANIZATION APPROVAL: N.D. Chanley	CODE IDENT NO. 50470 — SIZE C
CCC-CED-SWS	SCALE NONE — REVISION B — SHEET

FORM E44727

25804 C2-54-11

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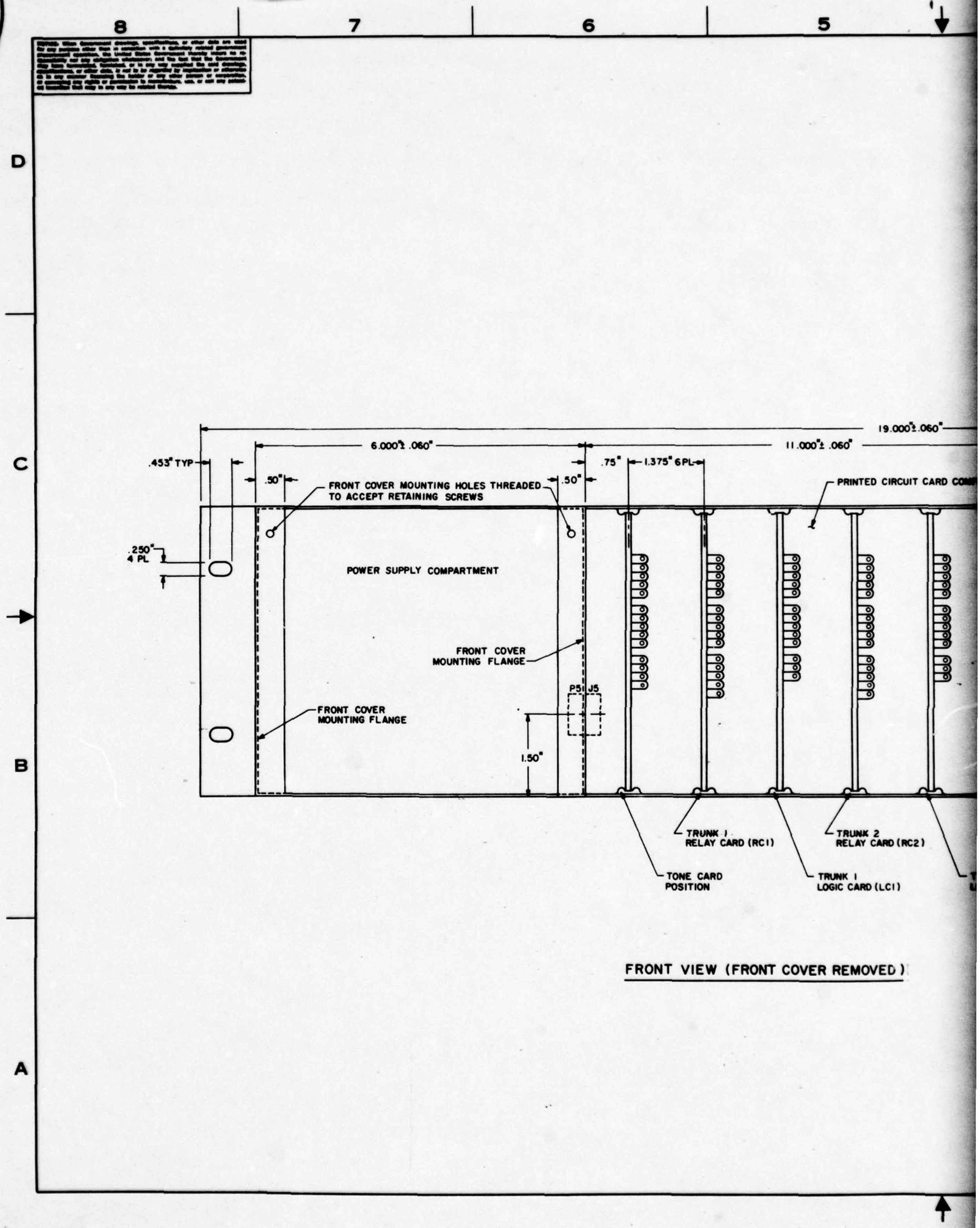
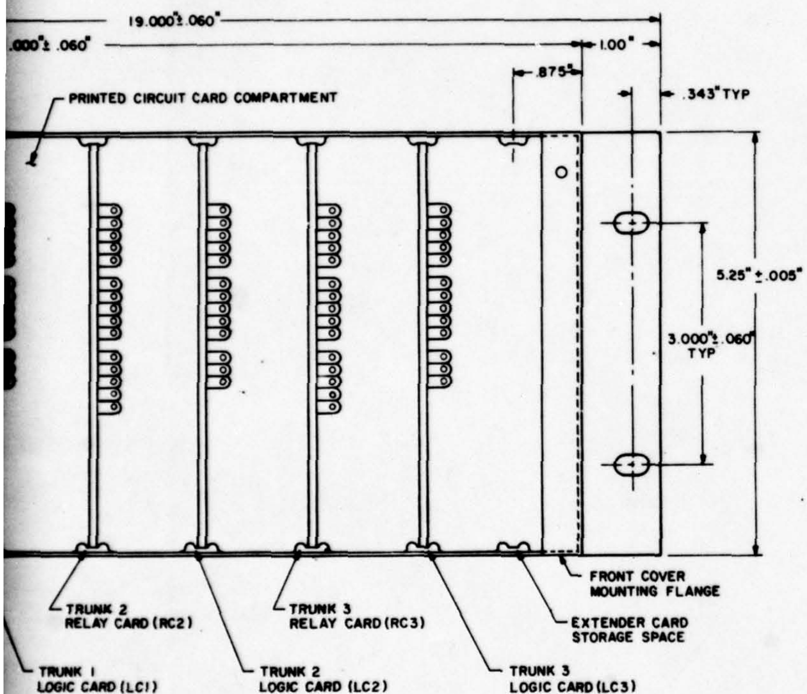


5 | 4 | 3 | 2 | 1

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		ADDED REV. STATUS SHEETS & REV. A TO SH. 1-2-3	12 JAN 77	R.A.O.
B		PANEL HEIGHT CHANGED, LOWER MOUNTING HOLES REMOVED & TEST POINTS CHANGED	5/11/77	A.A.O.
C		REVISED PER FIELD CORRECTIONS	26JUL77	R.A.O.
D		CHANGE NUMBER OF TEST POINTS AND ASSIGNED NEW DRAWING NUMBER. OLD NO. WAS 00000SV108M0001 SHEET 1 OF 3.	20OCT77	RJH

D

2



C

GENERAL NOTES:

1. CHASSIS TO BE CONSTRUCTED FROM .059"±.001" COLD ROLLED STEEL.

B

OVER REMOVED)

ITEM	DESCRIPTION	FSN	UI	QTY

LIST OF MATERIALS

D	D	D							
C	C	C							
B	B	B							
A	A	A							
1	2	3	4	5	6	7	8	9	10

SHEET NUMBER

REVISION STATUS OF SHEETS

STD-SV-0006
SHEET 1 OF 3

DESIGN BY OMARTIAN
DRAFTSMAN J. KALLBERG
CHECKER R Roll
DATE 7 SEP 76
ORGANIZATION APPROVAL N.D. Chandler
CCC-CED-SWS

ORGANIZATION
USACEEIA-CED
FORT HUACHUCA, ARIZONA

SECORD WIDEBAND TRUNK APPLIQUE UNIT
CHASSIS

CODE IDENT NO. 50470
SIZE D
SCALE NONE
REVISION D
SHEET

A

ENTERED IN USACEEIA EDD

C2-54 D1

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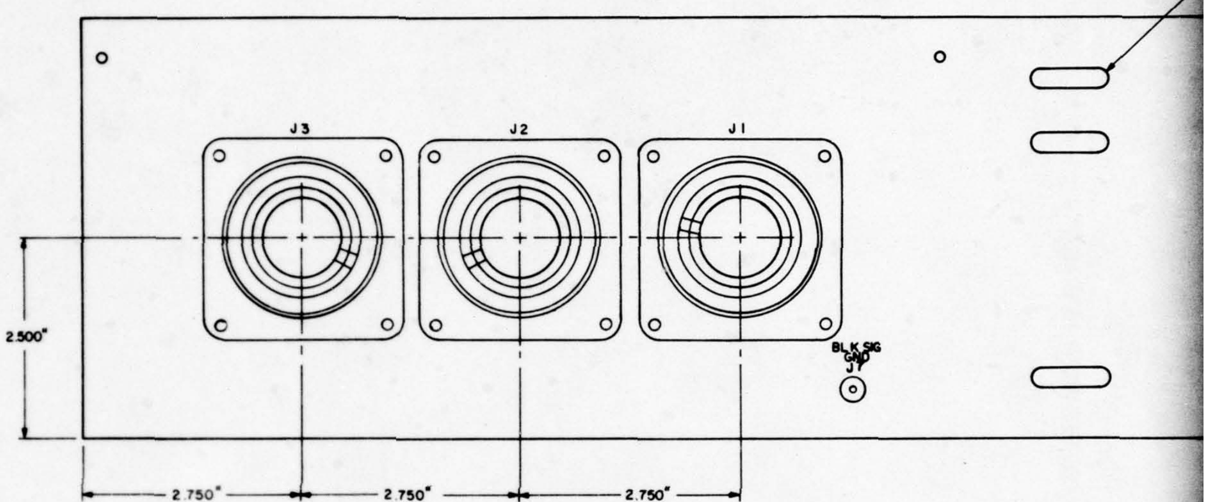
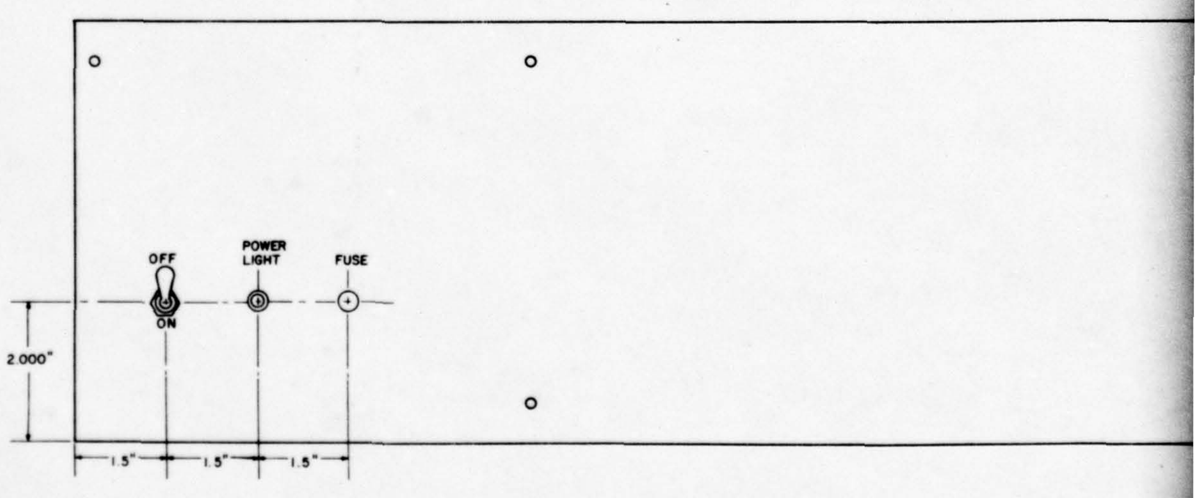


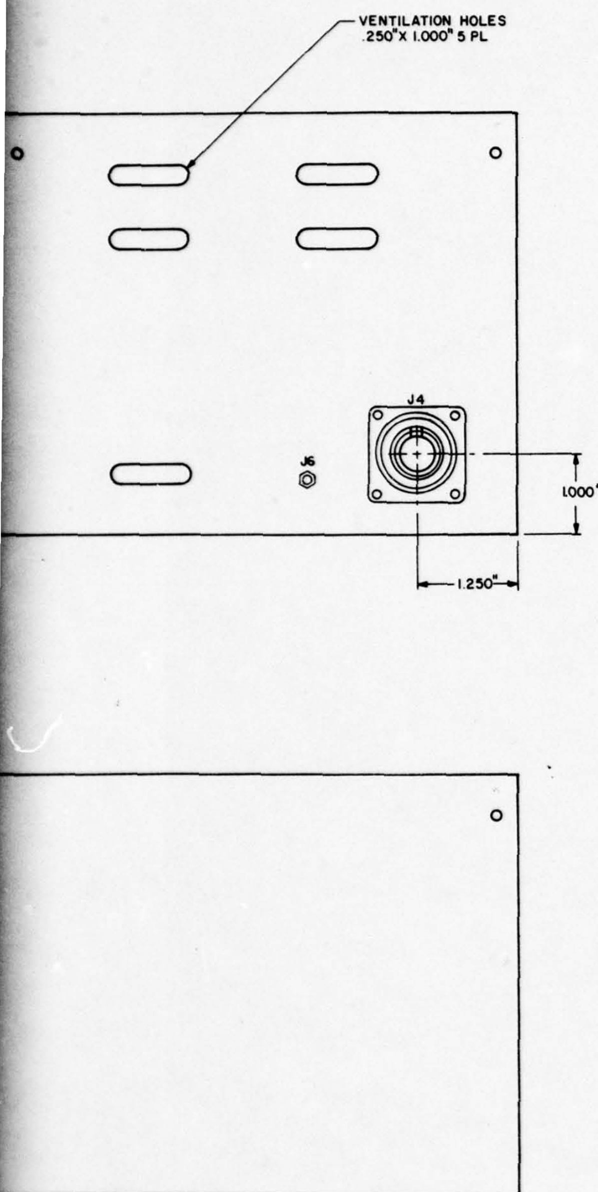
REAR COVER



FRONT COVER

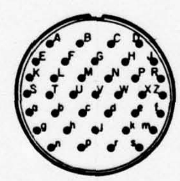
5 4 3 2 1

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		NOTE 201 ADDED	12 JAN 77	a.a.o.
B		J6 AND J7 ADDED	10 MAR 77	a.a.o.
C		LOWER MOUNTING HOLES REMOVED, KEY NOTCH ON J1, J2 & J3 CHANGED. SWITCH, FUSE & LAMP ADDED TO FRONT COVER & NOTE 202 ADDED	05/12/77	a.a.o.
D		CHANGE DWG NO. FROM 00000SV10BM0001 SH 2 OF 3	20OCT77	R.I.H.
E		ADDED J1, J2, AND J3 CONNECTOR PIN LAYOUT AND CHART W/NOTE 203 & 204	20DEC78	HmJ



NOTES:

201. FRONT AND REAR COVERS TO BE MADE OF .059" COLD ROLLED STEEL.
202. CONNECTORS J1, J2, J3, & J4 SHALL BE AFFIXED TO THE REAR COVER WITH MACHINE SCREWS.
203. SEE DRAWING STD-SV-0017 FOR SECORD INTERFACE DIAGRAM.
204. CABLE CONNECTORS FOR MATING WITH J1, J2, J3, & J4 ARE TO BE SUPPLIED WITH APPLIQUE UNIT.



J1, J2 OR J3
PIN LAYOUT
(NOTE 204)

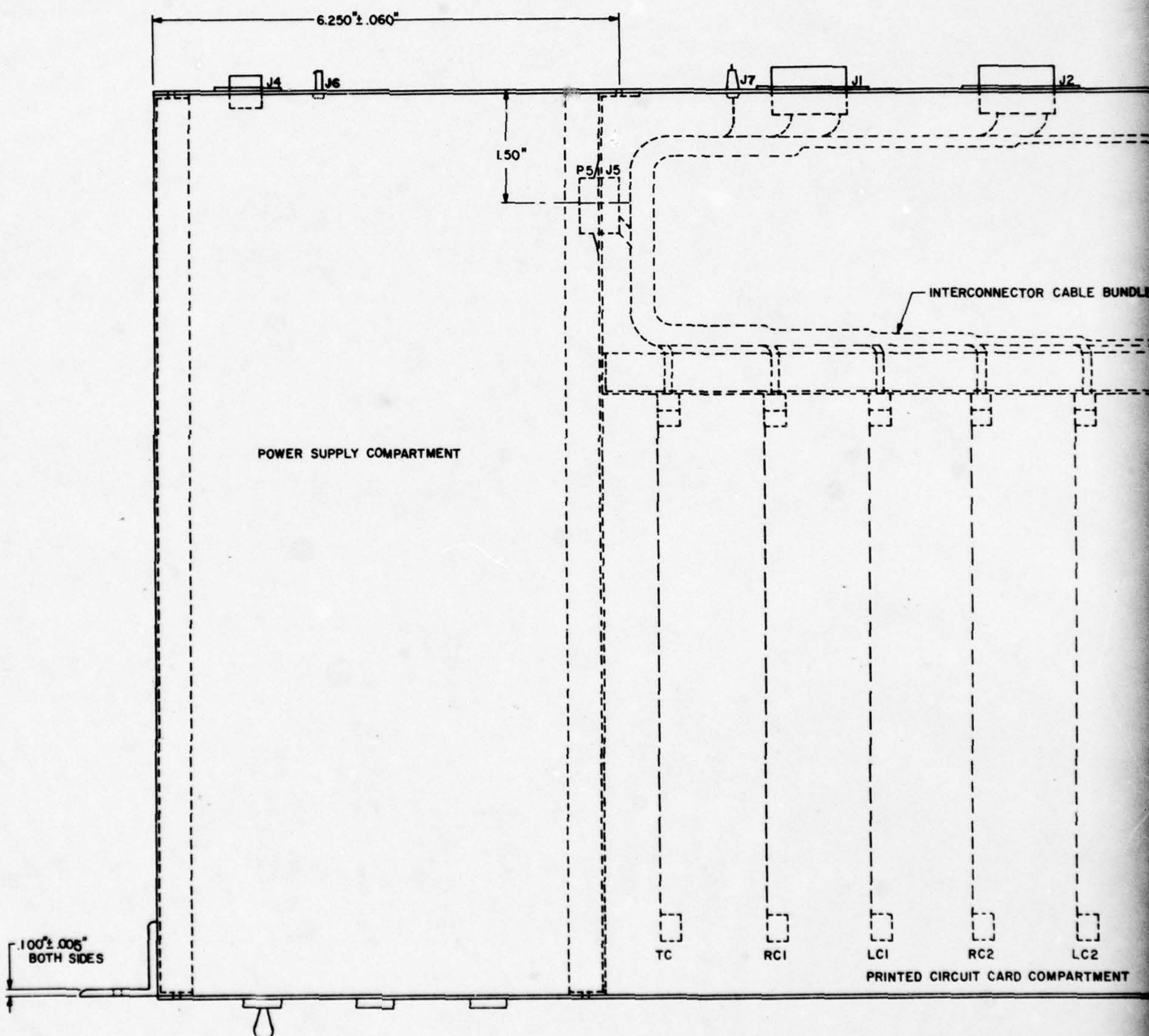
DESIGNATION	TERMINAL
4 WIRE LINE TRANSMIT	A, B
4 WIRE LINE RECEIVE	D, E
SWITCHBOARD LINE TRANSMIT	G, H
SWITCHBOARD LINE RECEIVE	K, L
CALL/ANSWER SWITCH	N
RING	P
CALL/ANSWER LIGHT	R
SECURE LIGHT	S
PATCH IN PLACE	V
PREEMPT LIGHT	W
PREEMPT OUT SWITCH	X
RESYNC SWITCH	Z
NB IN/OUT RECEIVE	a, b
NB IN/OUT TRANSMIT	d, e
TRANSMIT	g, h
RECEIVE	k, n

ITEM	DESCRIPTION	FSN	UI	QTY

LIST OF MATERIALS

STD-SV-0006 SHEET 2 OF 3	ORGANIZATION: USACEEIA-CED, FORT HUACHUCA, ARIZONA
DESIGN BY: OMARTIAN	SECORD WIDEBAND TRUNK APPLIQUE UNIT CHASSIS
DRAFTSMAN: J. KALLBERG	
CHECKER: R. Roth	
DATE: 7 SEP 76	
ORGANIZATION APPROVAL: N. D. Chanley, CCC-CED-SWS	CODE IDENT NO. 50470; SIZE D
	SCALE NONE; REVISION E; SHEET

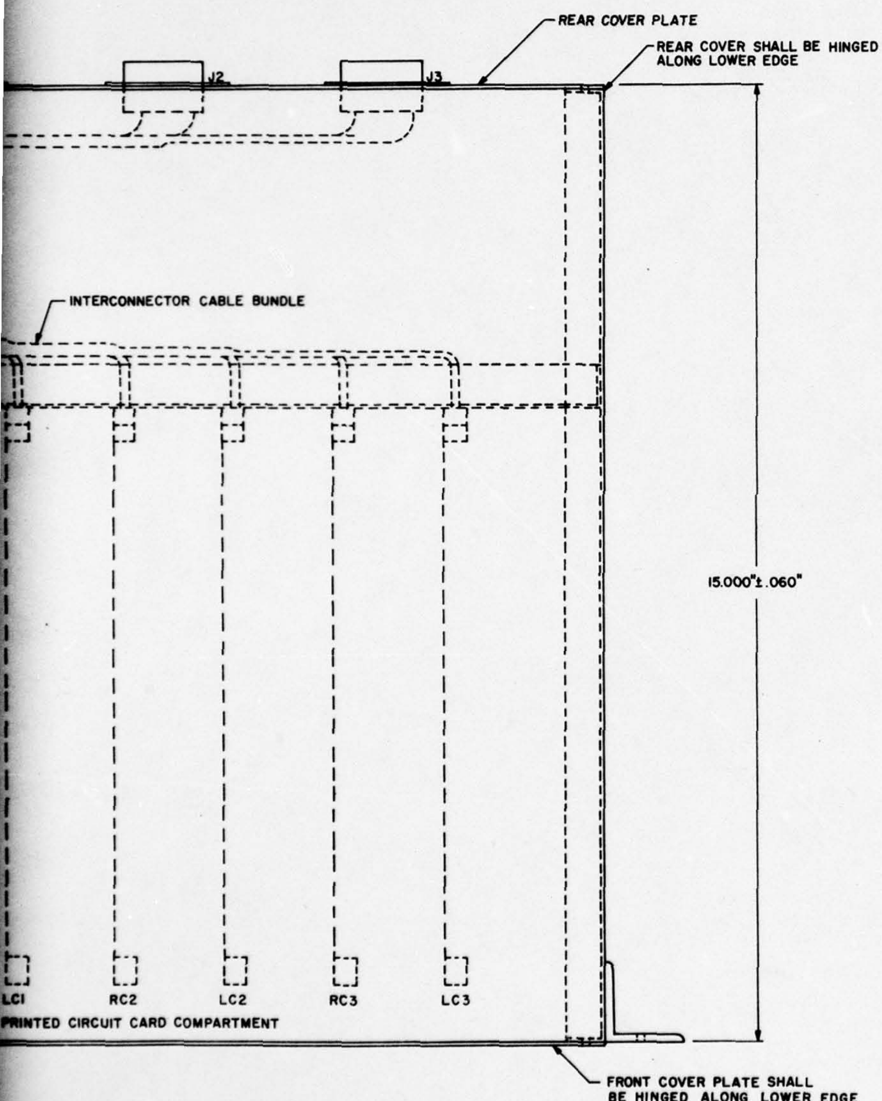
C-2-54-01


6.250"±.060"
J4
J6
J7
J1
J2
1.50"
P5
J5
INTERCONNECTOR CABLE BUNDLE
POWER SUPPLY COMPARTMENT
.100"±.005" BOTH SIDES
TC
RC1
LC1
RC2
LC2
PRINTED CIRCUIT CARD COMPARTMENT

TOP VIEW

5 4 3 2 1

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		BRACKET TOL. CHANGED TO .005"	12 JAN 77	a.a.o
B		J6 AND J7 ADDED	10 MAR 77	a.o.o
C		FRONT MOUNTING INSTRUCTIONS CHANGED, ADDED SWITCH, LAMP & FUSE PICTURE	12 MAY 77	a.a.o
D		CHASSIS DEPTH LENGTHENED AND CHANGE DWG. NO. FROM 00000SV10BM0001 SH 3 OF 3	20 OCT 77	RIH



ITEM	DESCRIPTION	FSN	UI	QTY

LIST OF MATERIALS

STD-SV-0006 SHEET 3 OF 3	ORGANIZATION USACEEIA-CED FORT HUACHUCA, ARIZONA
DESIGN BY OMARTIAN	SECORD WIDEBAND TRUNK APPLIQUE UNIT CHASSIS
DRAFTSMAN J. KALLBERG	
CHECKER OR Roff	
DATE 8 SEP 76	
ORGANIZATION APPROVAL N D Chanley CCC-CED-SWS	CODE IDENT NO. 50470 SIZE D
SCALE NONE	REVISION D SHEET

ENTERED IN CONCLUSION C2-54-41

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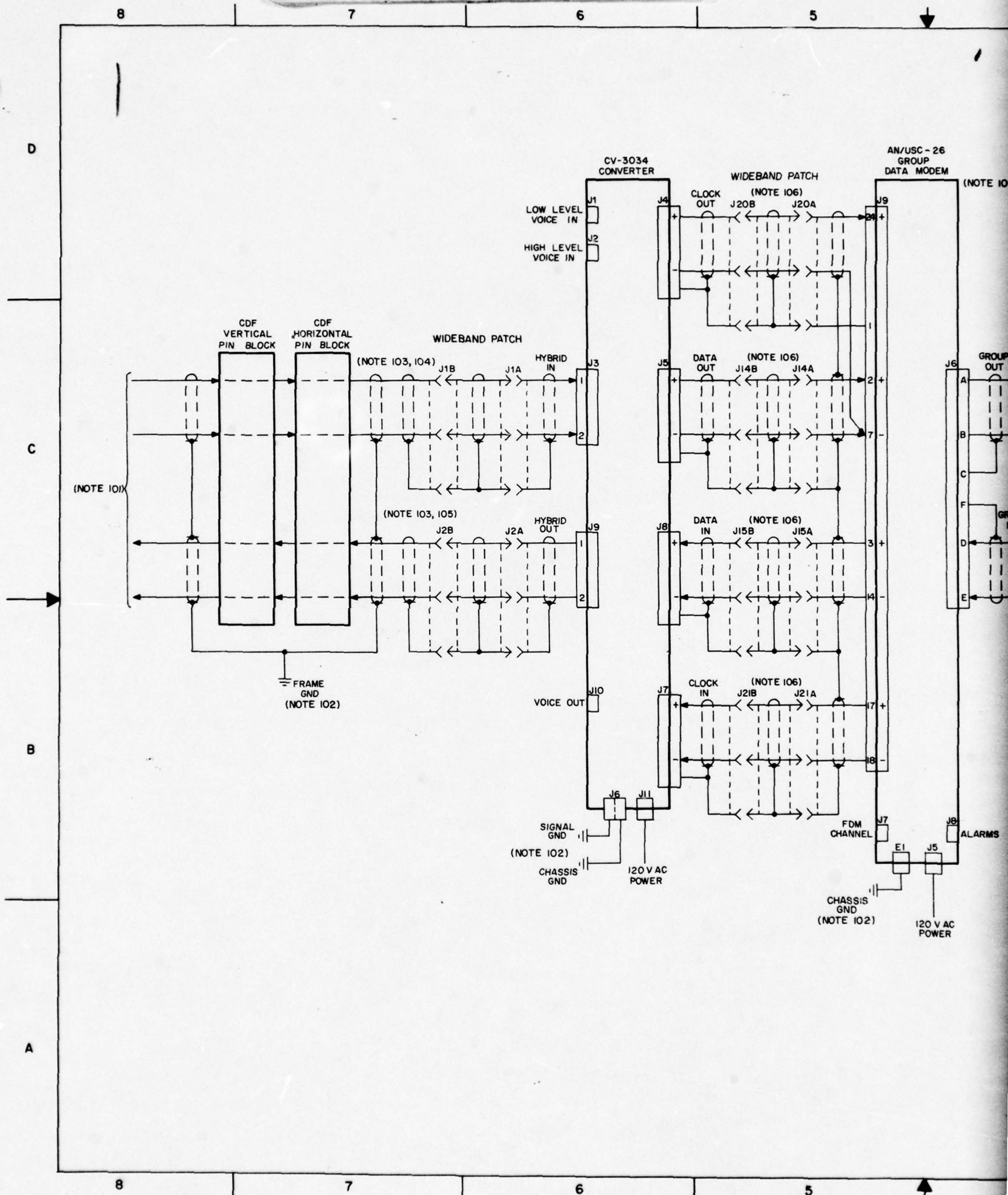
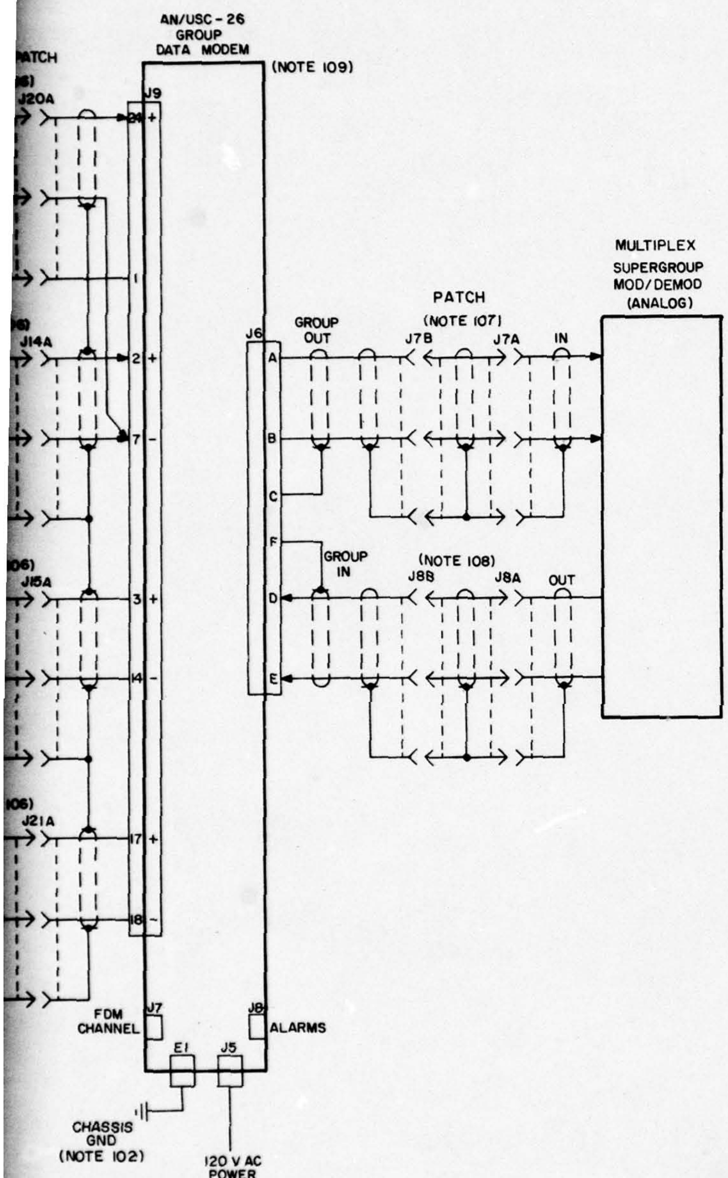


ZONE	REV	DESCRIPTION	DATE	APPROVED

REVISION



NOTES:

101. TELEPHONE CABLE PAIRS TO AN/FTC-31 OR WESTERN ELECTRIC 758C ELECTRONIC SWITCHES OR WIDEBAND APPLIQUE UNIT.

102. FRAME GROUND AND SIGNAL GROUND ARE A PART OF THE SIGNAL REFERENCE SUBSYSTEM OR "YELLOW WIRE" GROUND. CHASSIS GROUND IS A PART OF THE EQUIPMENT FAULT PROTECTIVE SUBSYSTEM OR "GREEN WIRE" GROUND. SEE ARMY FM 11-487-4.

103. HYBRID SIGNALS CONSIST OF BOTH VOICE AND DIGITAL SIGNALS DEPENDING UPON THE MODE OF OPERATION AT THE SUBSCRIBER EQUIPMENT.

104. HYBRID (VOICE/DIGITAL) VOICE LEVEL -30 TO 0 dbm, DIGITAL LEVEL -15 TO 0 dbm.

105. HYBRID (VOICE/DIGITAL) VOICE LEVEL -30 TO 0 dbm (ADJUSTABLE), DIGITAL LEVEL 0 $\pm$ 1 dbm.

106. 50 kb/s DIGITAL $\pm$ 3 V NON-RETURN TO ZERO (NRZ).

107. 60-108 kHz FREQUENCY RANGE AT +5 TO -40 dbm adjustable in 1-db STEPS.

108. 60-108 kHz FREQUENCY RANGE AT +5 TO -40 dbm.

109. THE AN/USC-26 GROUP DATA MODEM IS NOT REQUIRED FOR THE CV-3034/G TO INTERFACE WITH DIGITAL MULTIPLEX SYSTEMS.

ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0008	ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY	
DESIGN BY C. McKASKLE	DATE DEC 78	WBSVNEP INTERCONNECT DIAGRAM (TYPICAL SINGLE CONVERTER)
DRAWN BY G. VERDI	DEC 78	
CHECKED BY F. E. MYERS, JR.	DEC 78	
APPROVAL H M Solis	ACTIVITY CCC-CED-SEP	SIZE D · FSCM NO. 50470 · DRAWING NO.
PROJECT		SCALE NONE · SHEET 1 OF 1

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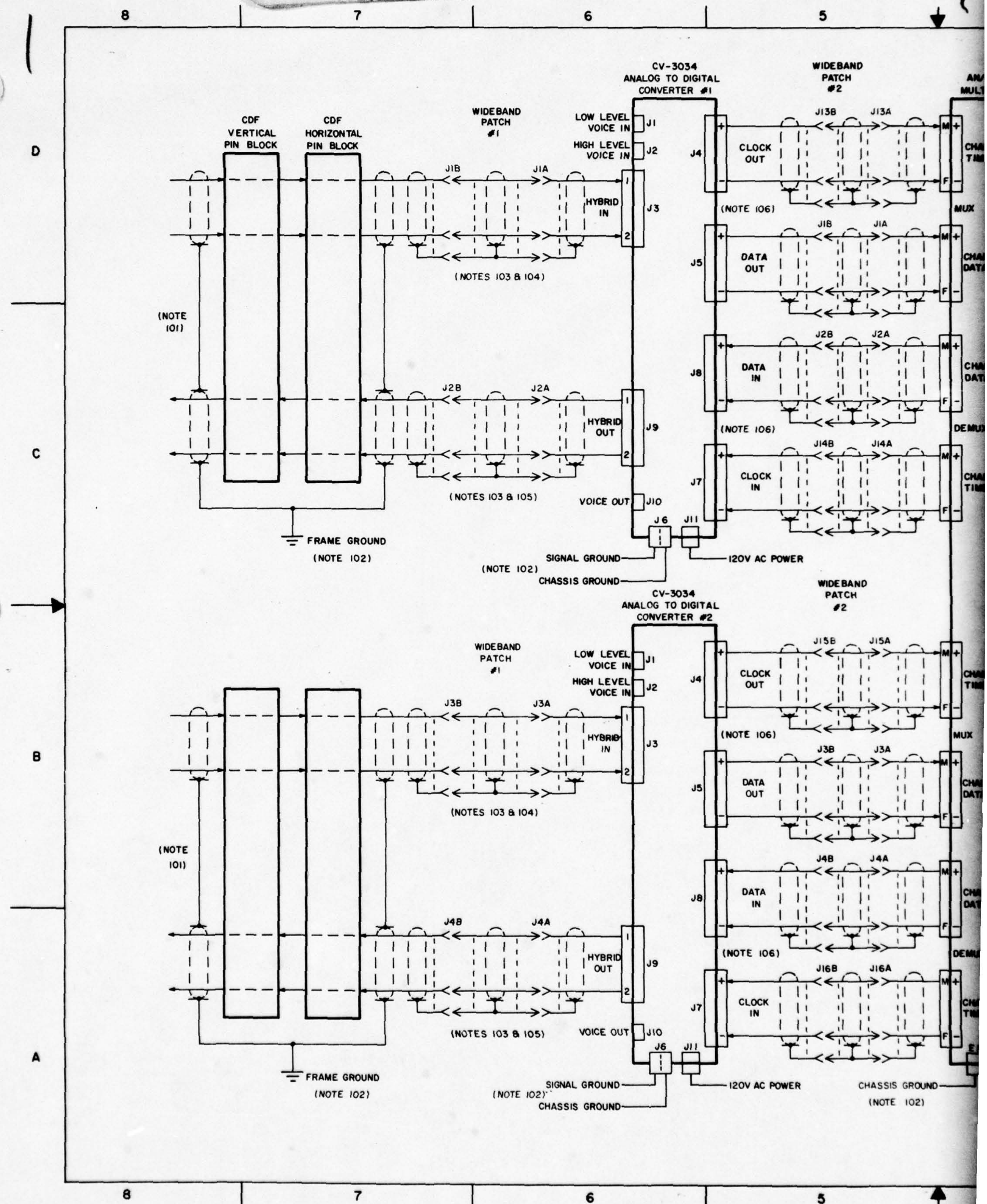


REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

NOTES:

101. TELEPHONE CABLE PAIRS TO AN/FTC-31 OR WESTERN ELECTRIC 758C ELECTRONIC SWITCHES OR WIDEBAND APPLIQUE UNIT.

102. FRAME GROUND AND SIGNAL GROUND ARE A PART OF THE SIGNAL REFERENCE SUBSYSTEM OR "YELLOW WIRE" GROUND. CHASSIS GROUND IS A PART OF THE EQUIPMENT FAULT PROTECTIVE SUBSYSTEM OR "GREEN WIRE" GROUND. SEE ARMY FM 11-487-4.

103. HYBRID SIGNALS CONSIST OF BOTH VOICE AND DIGITAL SIGNALS DEPENDING UPON THE MODE OF OPERATION AT THE SUBSCRIBER EQUIPMENT.

104. HYBRID (VOICE/DIGITAL) VOICE LEVEL -30 TO 0 dbm, DIGITAL LEVEL -15 TO 0 dbm.

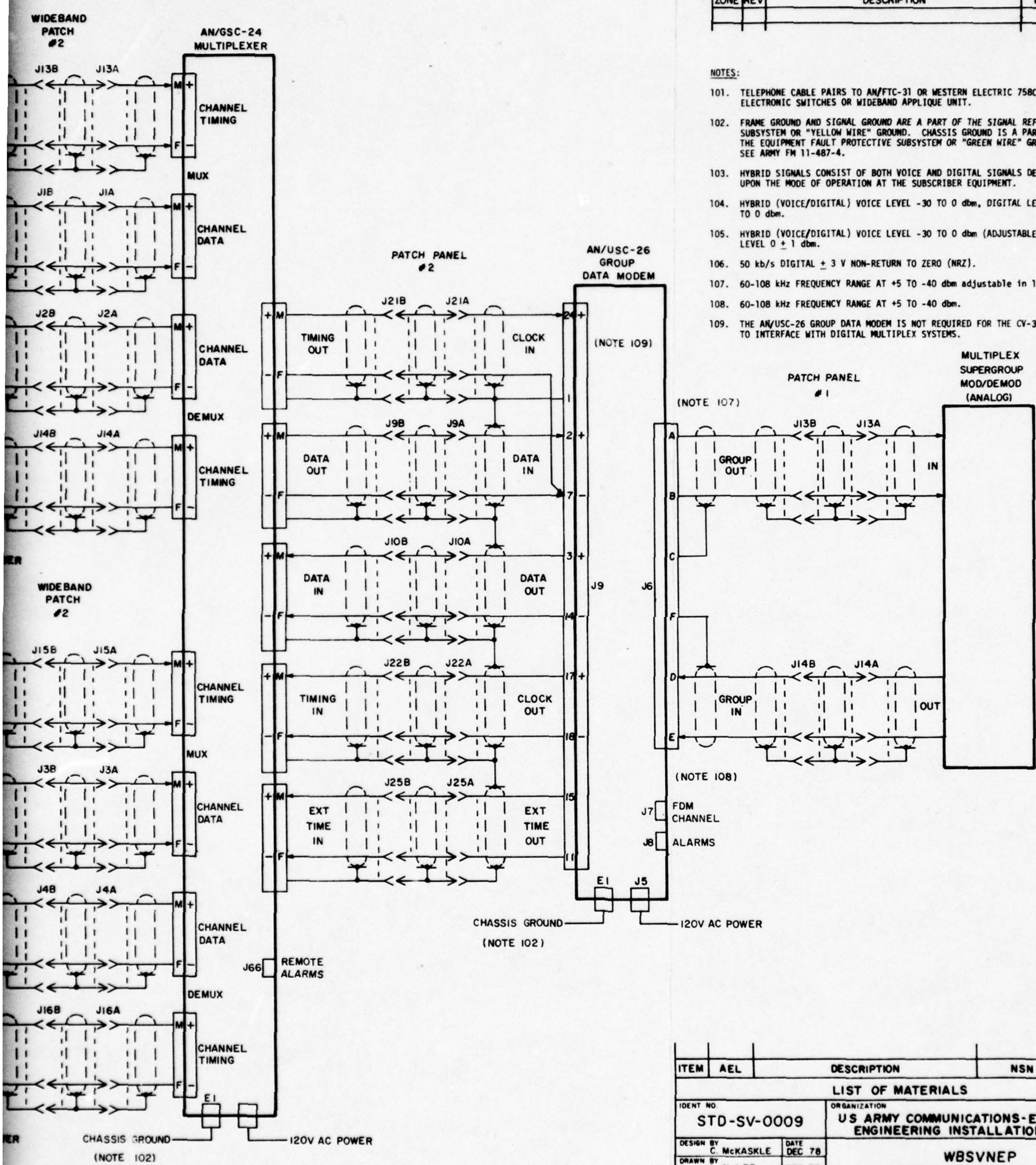
105. HYBRID (VOICE/DIGITAL) VOICE LEVEL -30 TO 0 dbm (ADJUSTABLE), DIGITAL LEVEL 0 ± 1 dbm.

106. 50 kb/s DIGITAL ± 3 V NON-RETURN TO ZERO (NRZ).

107. 60-108 kHz FREQUENCY RANGE AT +5 TO -40 dbm adjustable in 1-db STEPS.

108. 60-108 kHz FREQUENCY RANGE AT +5 TO -40 dbm.

109. THE AN/USC-26 GROUP DATA MODEM IS NOT REQUIRED FOR THE CV-3034/G TO INTERFACE WITH DIGITAL MULTIPLEX SYSTEMS.



ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0009		ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE	DATE DEC 78	WBSVNEP INTERCONNECT DIAGRAM (TYPICAL DUAL CONVERTER)
DRAWN BY L. H. LEE	DEC 78	
CHECKED BY F. E. MYERS, JR.	DEC 78	
APPROVAL [signature] PROJECT	ACTIVITY CCC-CED-SEP	SIZE D · FSCM NO. 50470 · DRAWING NO.
SCALE NONE		SHEET 1 OF 1

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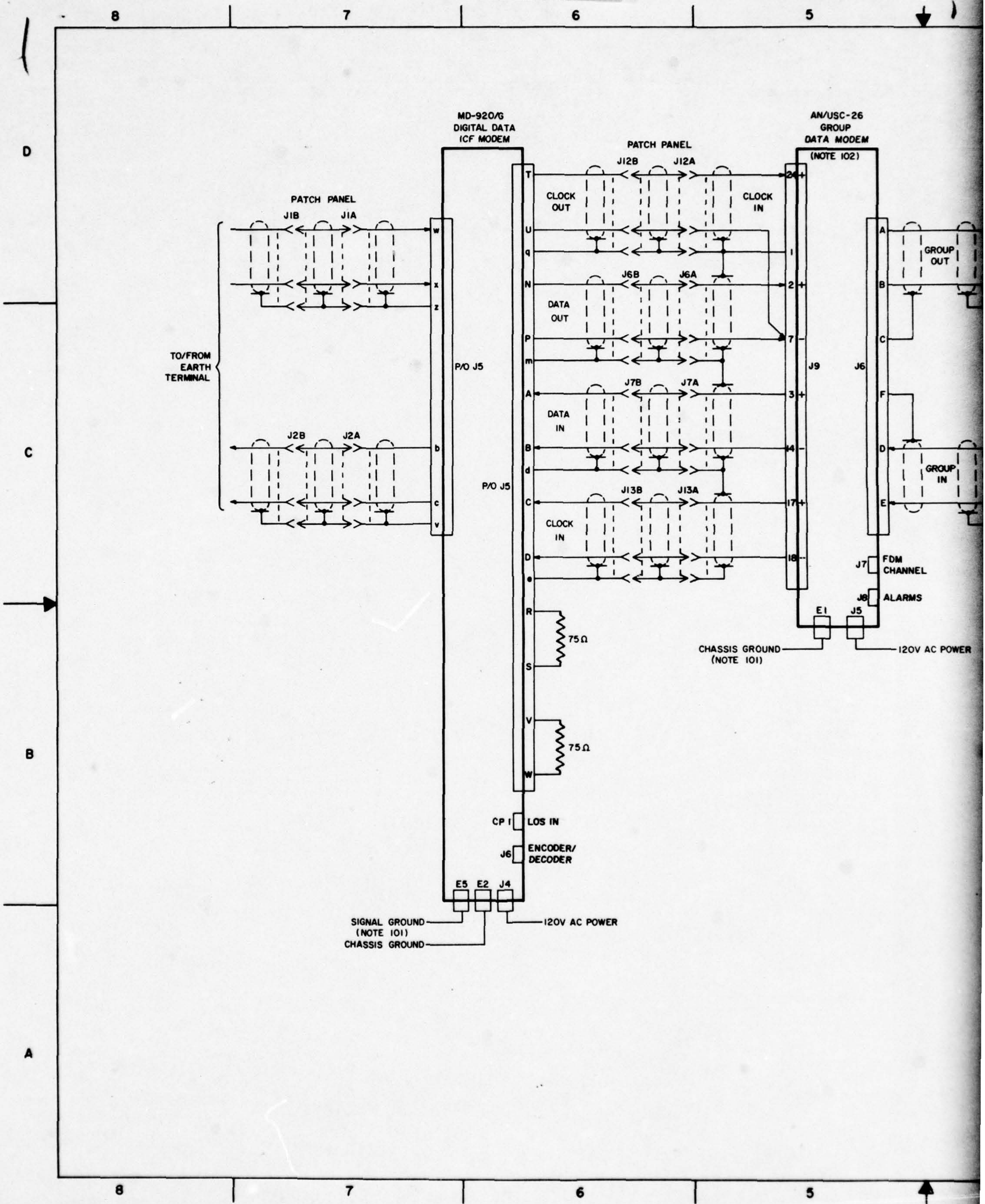
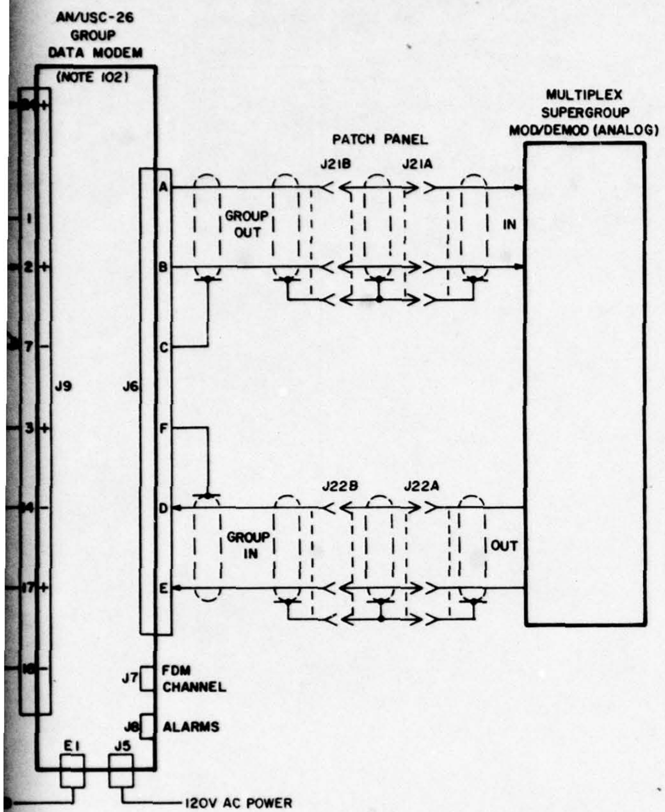


REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2



NOTES:

101. THE SIGNAL GROUND IS PART OF THE SIGNAL REFERENCE SUBSYSTEM, OR "YELLOW WIRE" GROUND. THE CHASSIS GROUND IS PART OF THE EQUIPMENT FAULT PROTECTIVE SUBSYSTEM, OR "GREEN WIRE" GROUND. SEE FM 11-487-4.

102. THE AN/USC-26 GROUP DATA MODEM IS NOT REQUIRED FOR THE DIGITAL DATA MODEM MD-920/G TO INTERFACE WITH DIGITAL MULTIPLEX SYSTEMS.

ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0010

ORGANIZATION: US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY

	DATE
DESIGN BY C. McKASKLE	DEC 78
DRAWN BY L. H. LEE	DEC 78
CHECKED BY F.E. MYERS, JR.	DEC 78

WBSVNEP
INTERCONNECT DIAGRAM
(TYPICAL EARTH TERMINAL)

APPROVAL: H.M. Sohin
ACTIVITY: CCC-CED-SEP
PROJECT

SIZE D | FSCM NO. 50470 | DRAWING NO.

SCALE NONE | SHEET 1 OF 1

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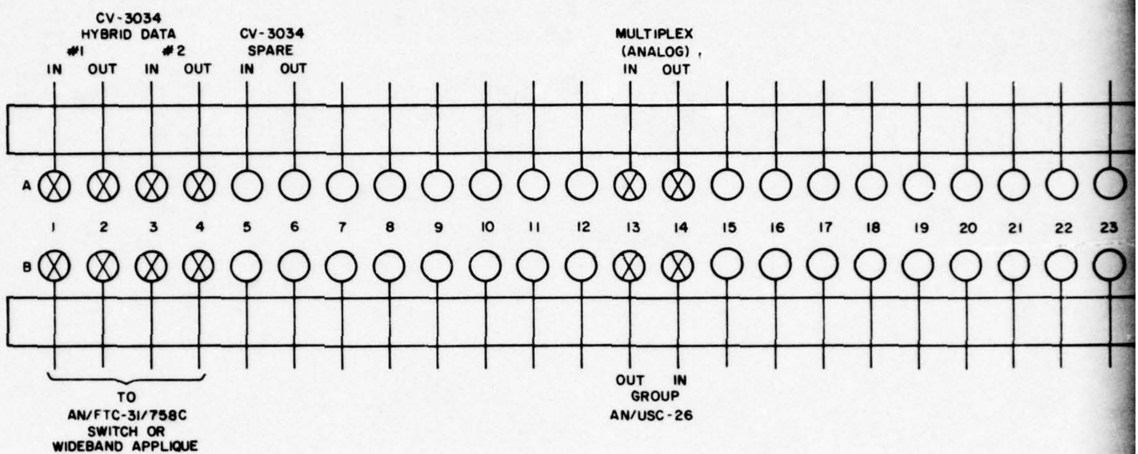
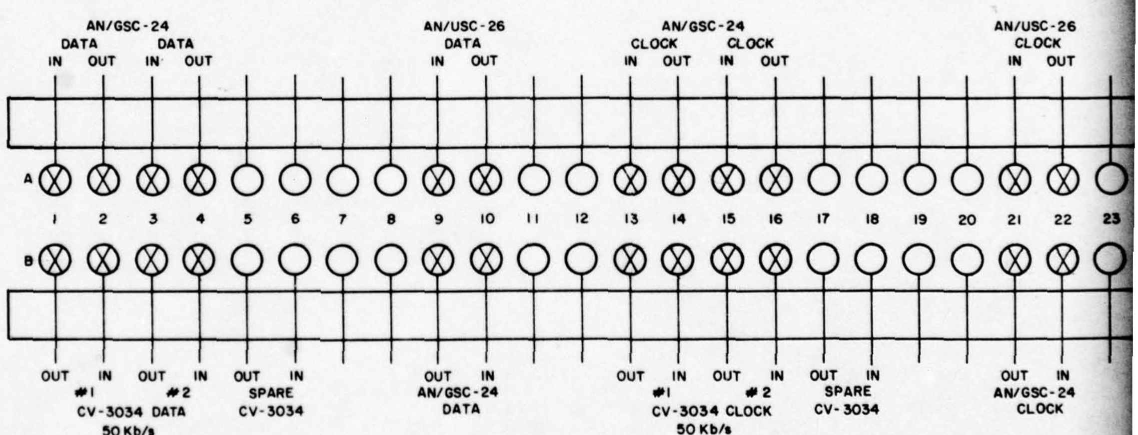


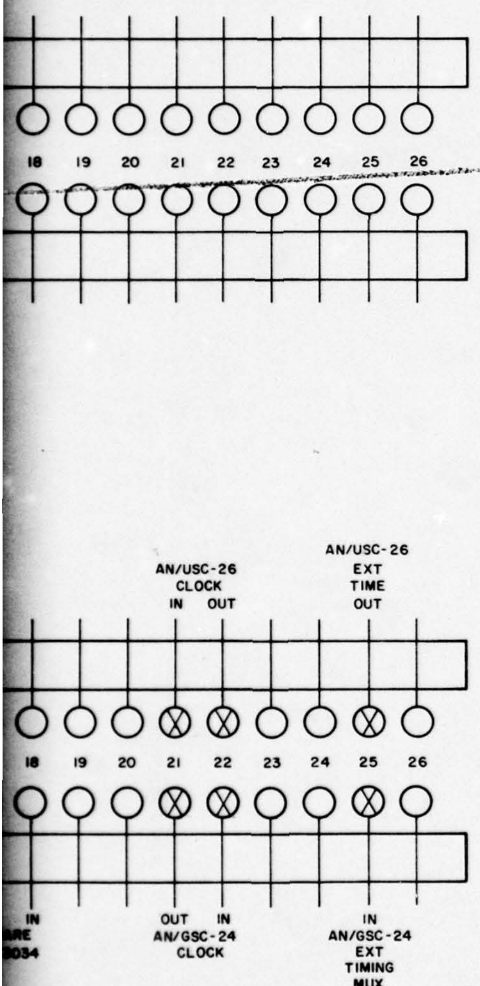
PATCH PANEL #1 (135 OHM)
(DUAL CONVERTER)



PATCH PANEL #2 (75 OHM)
(DUAL CONVERTER)

ZONE	REV	DESCRIPTION	DATE	APPROVED
REVISION				

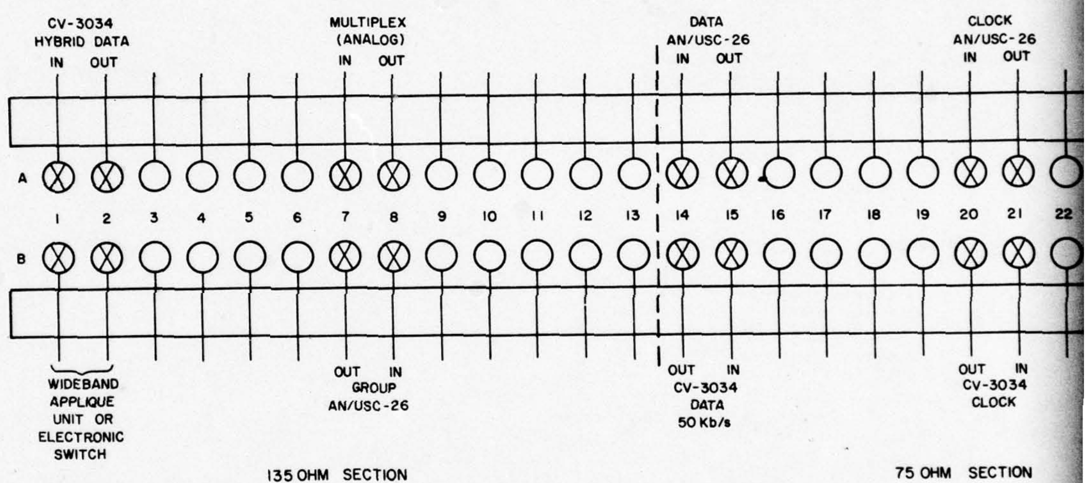
2



ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0011	ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE, DATE DEC 78	WBSVNEP
DRAWN BY G. VERDI, DEC 78	PATCH PANEL LAYOUT
CHECKED BY F. E. MYERS, JR, DEC 78	(SINGLE/DUAL CONVERTER CONFIGURATIONS)
APPROVAL [signature] ACTIVITY CCC-CED-SEP	SIZE D, FSCM NO. 50470, DRAWING NO.
PROJECT	SCALE NONE, SHEET 1 OF 2

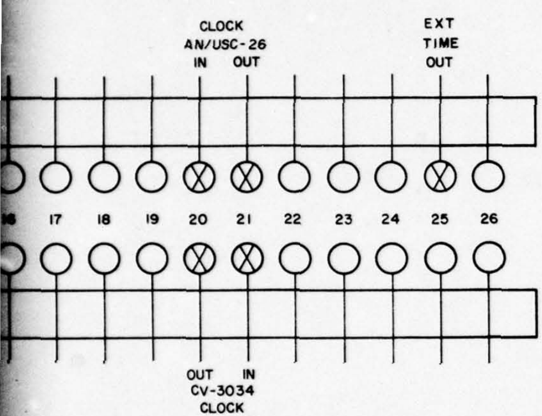


PATCH PANEL
(SINGLE CONVERTER)

ZONE	REV	DESCRIPTION	DATE	APPROVED

REVISION

2



75 OHM SECTION

IDENT NO. STD-SV-0011	SIZE D	FSCM NO. 50470	DRAWING NO.
DRAWN BY G VERDI			
APPROVED	SCALE NONE		SHEET 2 OF 2

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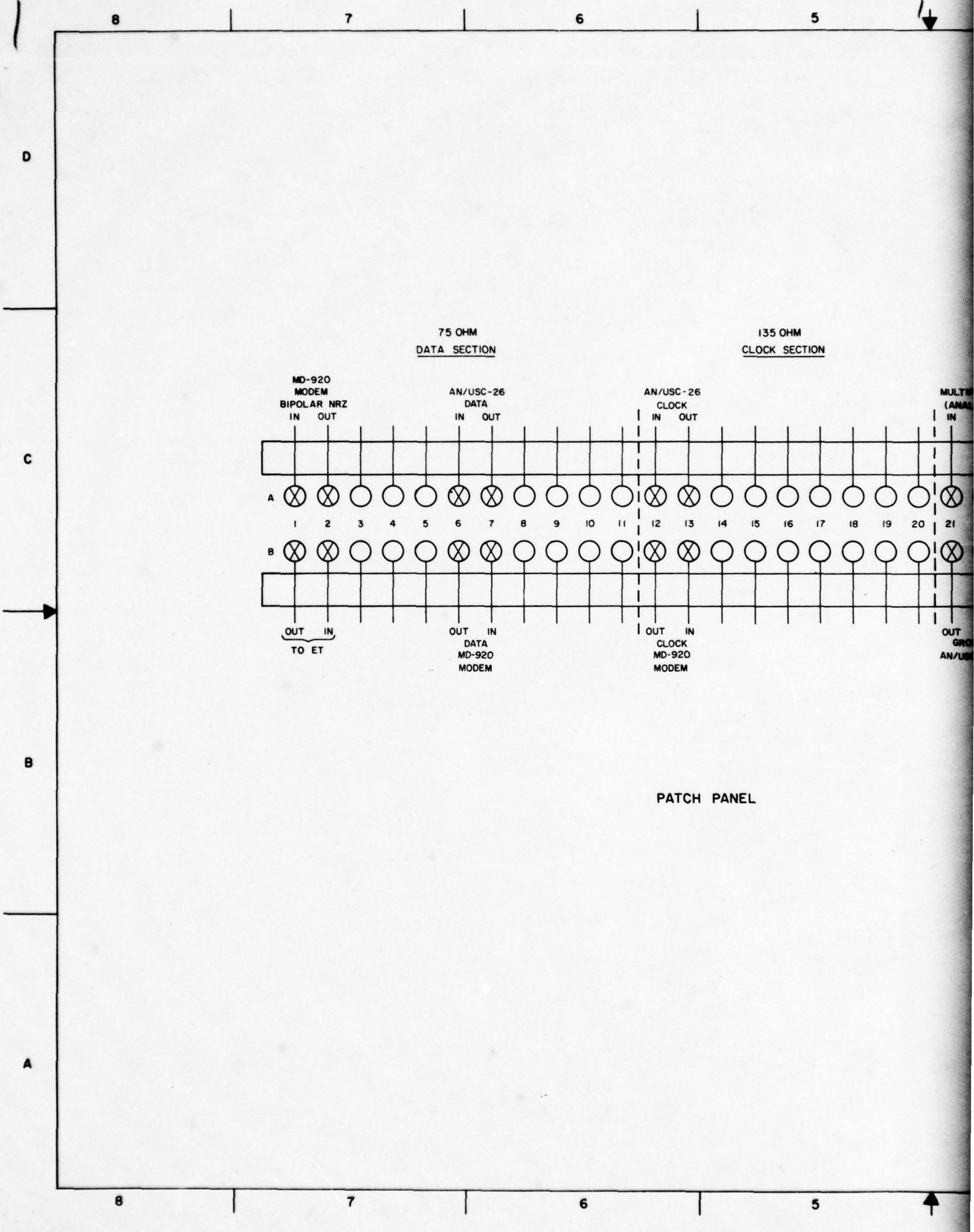


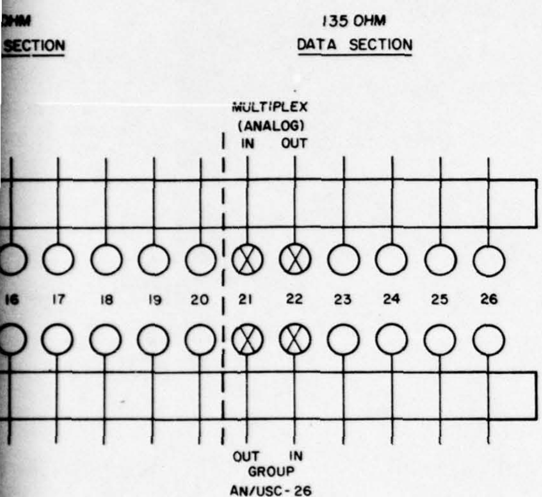
PATCH PANEL

5 4 3 2 1

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2

D



C

B

A

ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0012		ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE	DATE DEC 78	WBSVNEP PATCH PANEL LAYOUT (TYPICAL EARTH TERMINAL)
DRAWN BY G. VERDI	DEC 78	
CHECKED BY F. E. MYERS, JR.	DEC 78	
APPROVAL (signature) PROJECT	ACTIVITY CCC-CED-SEP	SIZE D · FSCM NO. 50470 · DRAWING NO.
		SCALE NONE · SHEET 1 OF 1

5 4 3 2 1

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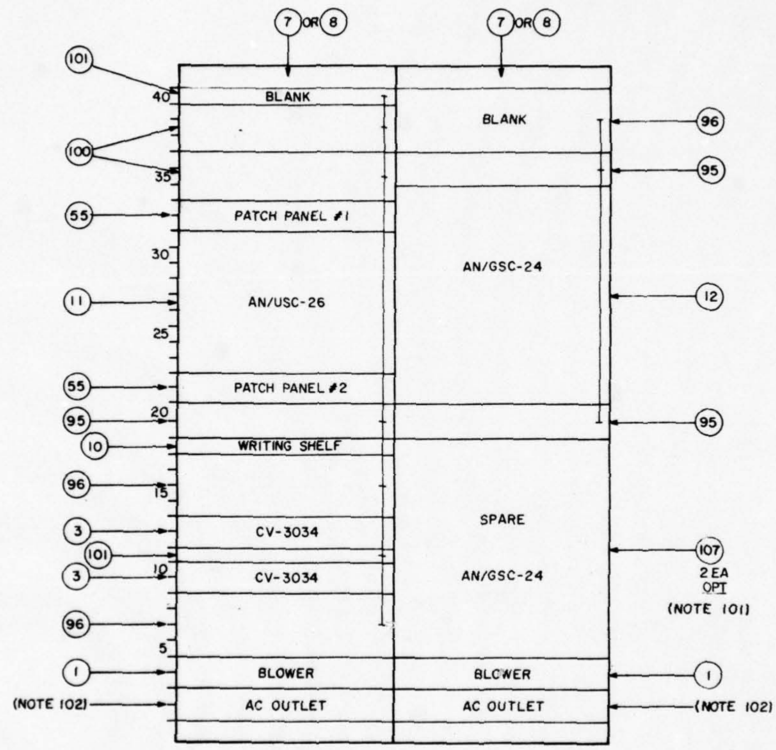
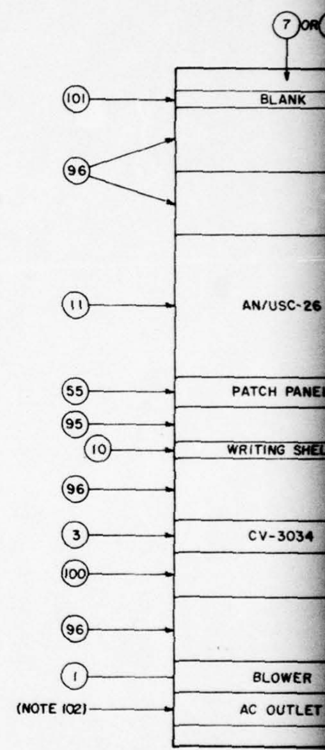


DUAL CONVERTER



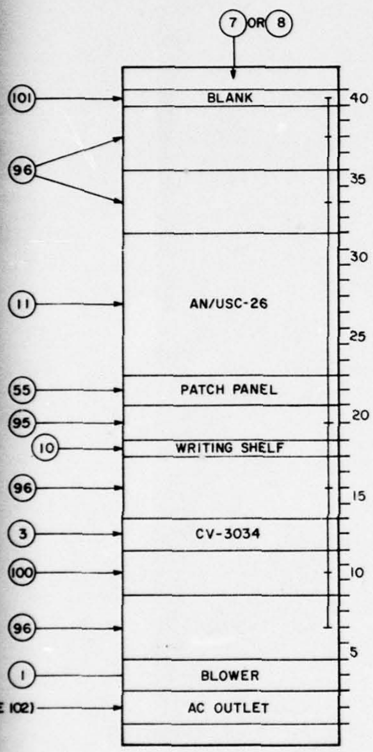
SINGLE CONV

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

NOTES:

101. WHEN A SPARE MULTIPLEXER AN/GSC-24 IS NOT REQUIRED, TWO BLANK PANELS (BOM ITEM 107) MAY BE INSTALLED IN THIS POSITION.

102. THE AC CONVENIENCE OUTLET IS CONSTRUCTED IN ACCORDANCE WITH DRAWING STD-MS-0017, SHEET 7.



SINGLE CONVERTER

ITEM	AEL	DESCRIPTION	NSN	UI	QTY
107	19752M	PANEL, BLANK, 19 IN X 12-1/4 IN, ALUMINUM	5975-00-J01-3722	EA	
101	00879Z	PANEL, BLANK, 19 IN X 1-3/4 IN, ALUMINUM	5975-00-937-4583	EA	
100	08711J	PANEL, BLANK, 19 IN X 5-1/4 IN ALUMINUM	5975-00-937-4501	EA	
96	19751N	PANEL, BLANK, 19 IN X 7 IN, ALUMINUM	5975-00-685-9539	EA	
95	19548A	PANEL, BLANK, 19 IN X 3-1/2 IN, ALUMINUM	5975-00-685-9538	EA	
55	19664M	PANEL, PATCH, TROMPETER NO JSI-52	5820-00-572-5533	EA	
12	21218Z	MULTIPLEXER SET, AN/GSC-24	NSNR	EA	
11	18302K	MODEM, DIGITAL DATA, AN/USC-26	5805-01-016-7723	EA	
10	19647A	SHELF, RETRACTABLE, FRAME MTG	7125-00-J01-3695	EA	
8	19625A	FRAME ASSEMBLY, ELECT EQPT, W/O SIDES	5895-00-J01-3731	EA	
7	19624Z	FRAME ASSEMBLY, ELECT EQPT, W/2 SIDES	5895-00-J01-3729	EA	
3	18352P	CONVERTER, ANALOG-DIGITAL, CV-3034A/G	5805-01-018-4668	EA	
1	19648B	BLOWER ASSEMBLY, RACK MOUNTED, W/FILTER	4140-00-270-6775	EA	

LIST OF MATERIALS

IDENT NO. STD-SV-0013	ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE — DATE DEC 78; DRAWN BY L. H. LEE — DEC 78; CHECKED BY F. E. MYERS, JR. — DEC 78	WBSVNEP RACK FACE ELEVATIONS (SINGLE/DUAL CONVERTER CONFIGURATIONS)
APPROVAL R.M. Jolis — ACTIVITY CCC-CED-SEP; PROJECT	SIZE D — FSCM NO. 50470 — DRAWING NO.
	SCALE NONE — SHEET 1 OF 1

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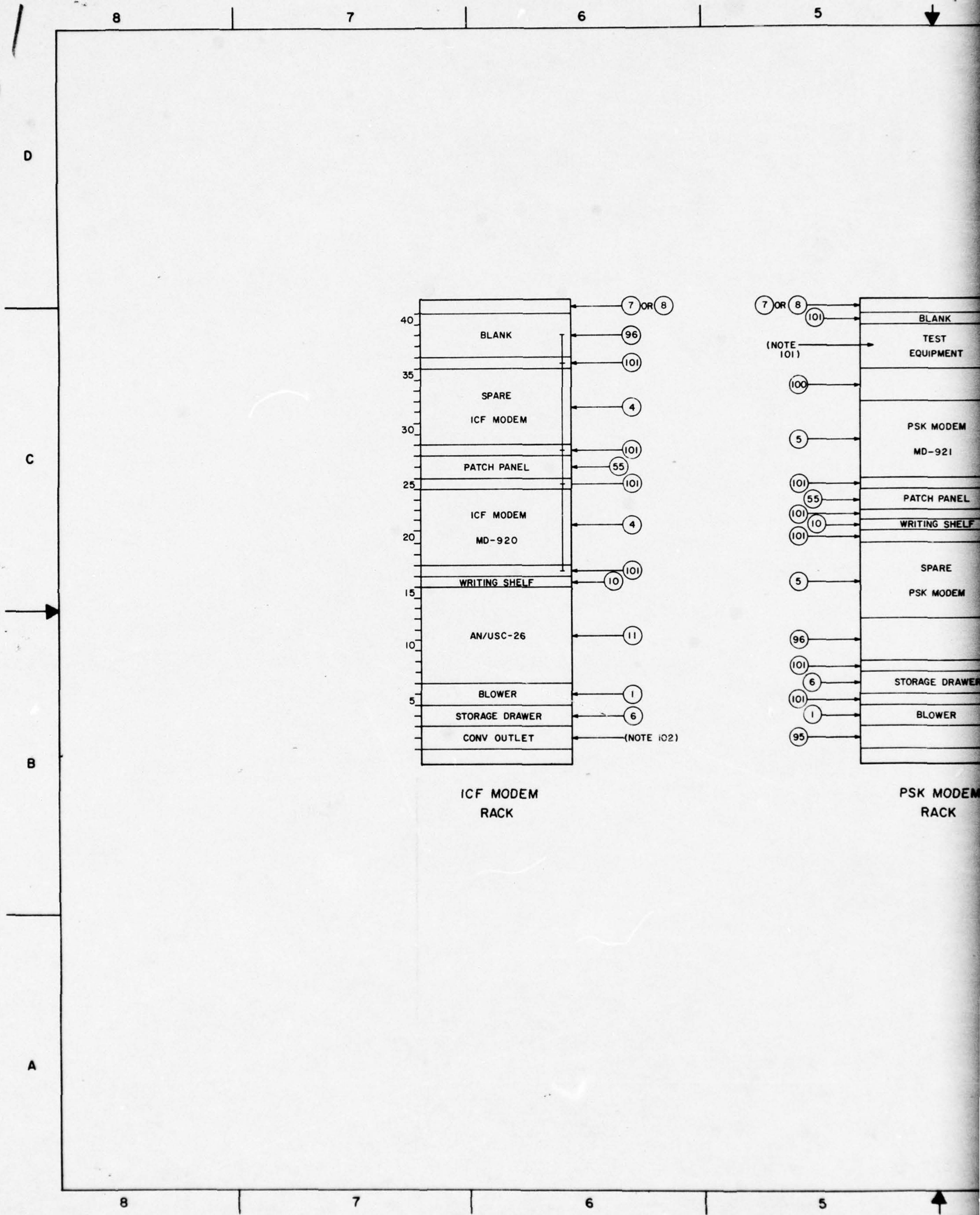
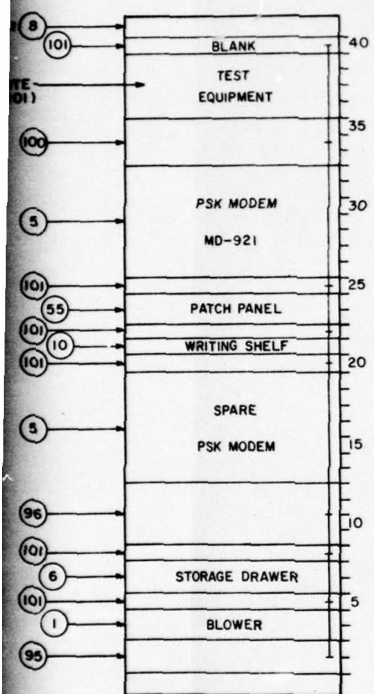


REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

NOTES:

101. BOM ITEM 96 MAY BE USED IN THIS POSITION UNTIL TEST EQUIPMENT IS DETERMINED.

102. THE AC CONVENIENCE OUTLET IS CONSTRUCTED IN ACCORDANCE WITH DRAWING STD-MS-0017, SHEET 7.



PSK MODEM
RACK

ITEM	AEL	DESCRIPTION	NSN	UI	QTY
101	00879Z	PANEL, BLANK, 19 IN X 1-3/4 IN, ALUMINUM	5975-00-937-4583	EA	
100	08711J	PANEL, BLANK, 19 IN X 5-1/4 IN ALUMINUM	5975-00-937-4501	EA	
96	19751N	PANEL, BLANK, 19 IN X 7 IN, ALUMINUM	5975-00-685-9539	EA	
95	19548A	PANEL, BLANK, 19 IN X 3-1/2 IN, ALUMINUM	5975-00-685-9538	EA	
55	19664M	PANEL, PATCH, TROMPETER NO JSI-52	5820-00-572-5533	EA	
11	18302K	MODEM, DIGITAL DATA, AN/USC-26	5805-01-016-7723	EA	
10	19647A	SHELF, RETRACTABLE, FRAME MTG	7125-00-J01-3695	EA	
8	19625A	FRAME ASSEMBLY, ELECT EQPT, W/O SIDES	5895-00-J01-3731	EA	
7	19624Z	FRAME ASSEMBLY, ELECT EQPT, W/2 SIDES	5895-00-J01-3729	EA	
6	19646Z	DRAWER, EQUIPMENT, FRAME MTD	5895-00-J01-3717	EA	
5	18307C	MODEM, DIGITAL DATA (PSK) MD-921/G	5820-00-155-8581	EA	
4	24140N	MODEM, DIGITAL DATA (ICF) MD-920/G	5820-00-155-8576	EA	
1	19648B	BLOWER ASSEMBLY, RACK MOUNTED, W/FILTER	4140-00-270-6775	EA	

LIST OF MATERIALS

IDENT NO. STD-SV-0014

ORGANIZATION: US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY

DESIGN BY	C. McKASKLE	DATE DEC 78
DRAWN BY	L. H. LEE	DEC 78
CHECKED BY	F. E. MYERS, JR	DEC 78

WBSVNEP
RACK FACE ELEVATIONS
(TYPICAL EARTH TERMINAL)

APPROVAL: Hm Sokis ACTIVITY: CCC-CED-SEP SIZE: D FSCM NO. 50470 DRAWING NO.

PROJECT SCALE: NONE SHEET 1 OF 1

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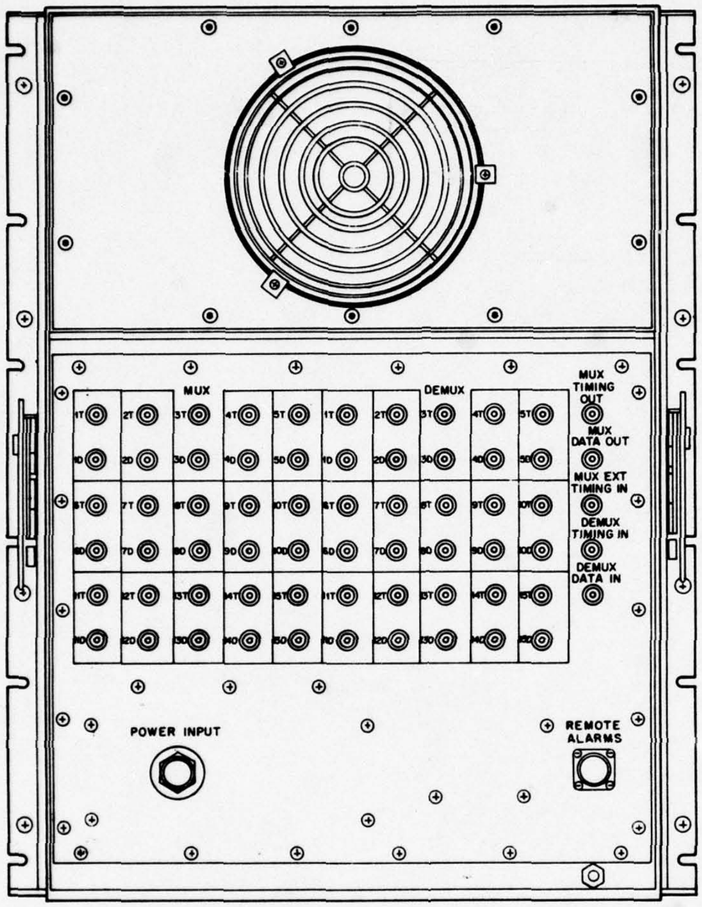
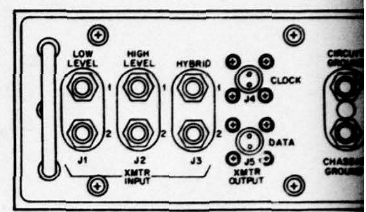
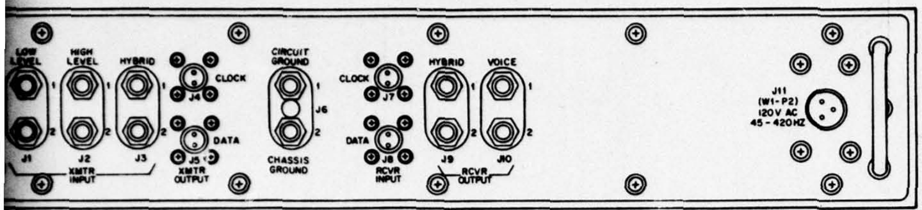




AN/GSC-24(V) MULTIPLEXER

(REAR VIEW)

ZONE	REV	DESCRIPTION	DATE	APPROVED
REVISION				

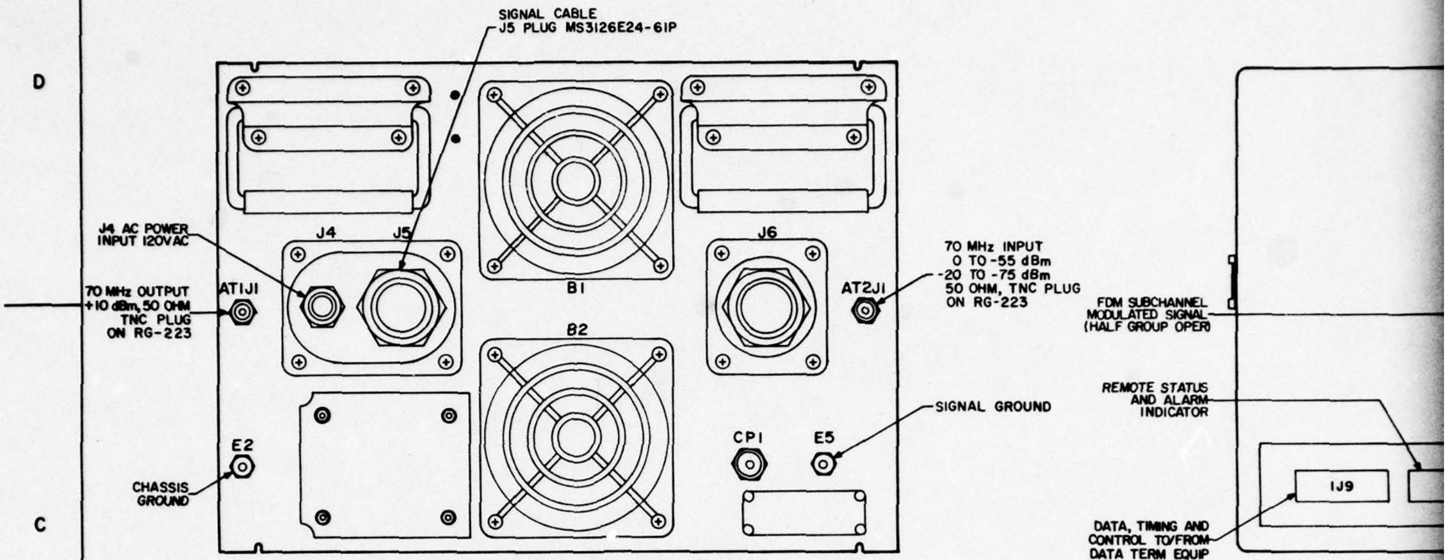


CV-3034 A/D CONVERTER
(REAR VIEW)

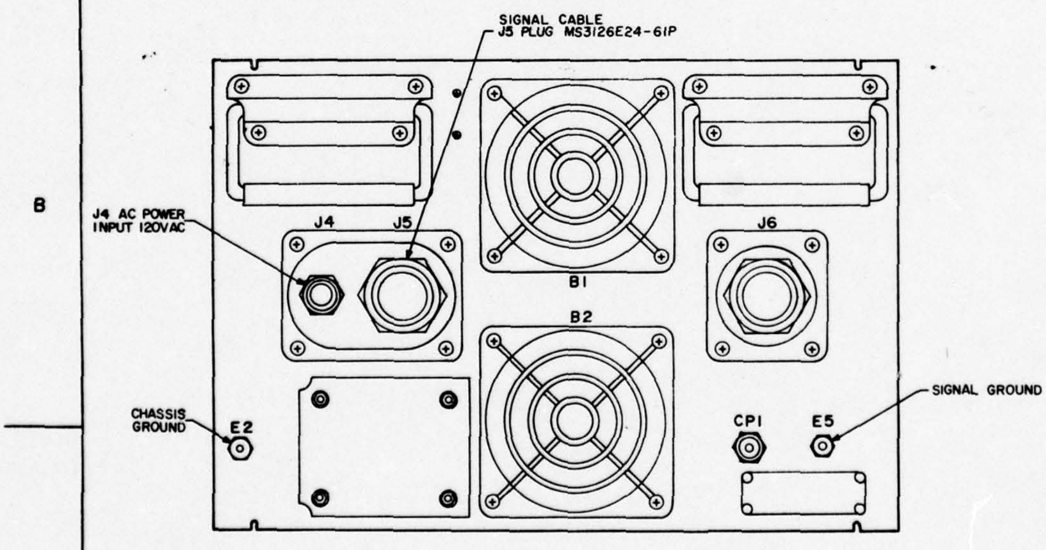
ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0015		ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE	DATE DEC 78	WBSVNEP CONVERTER AND MULTIPLEX EQUIPMENT
DRAWN BY L. H LEE	DEC 78	
CHECKED BY F.E. MYERS, JR.	DEC 78	
APPROVAL H.M. Soler	ACTIVITY CCC-CED-SEF	SIZE D · FSCM NO. 50470 · DRAWING NO.
PROJECT		SCALE NONE · SHEET 1 OF 1



MD-921 PSK MODEM
(REAR VIEW)

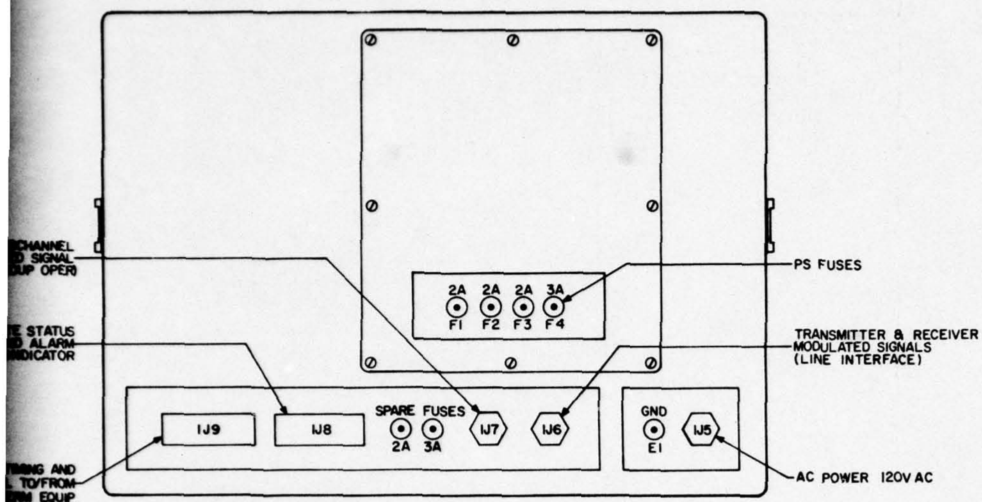


MD-920 ICF MODEM
(REAR VIEW)

5	4	3	2	1

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2



AN/USC-26 GDM
(REAR VIEW)

ITEM	AEL	DESCRIPTION	NSN	UI	QTY

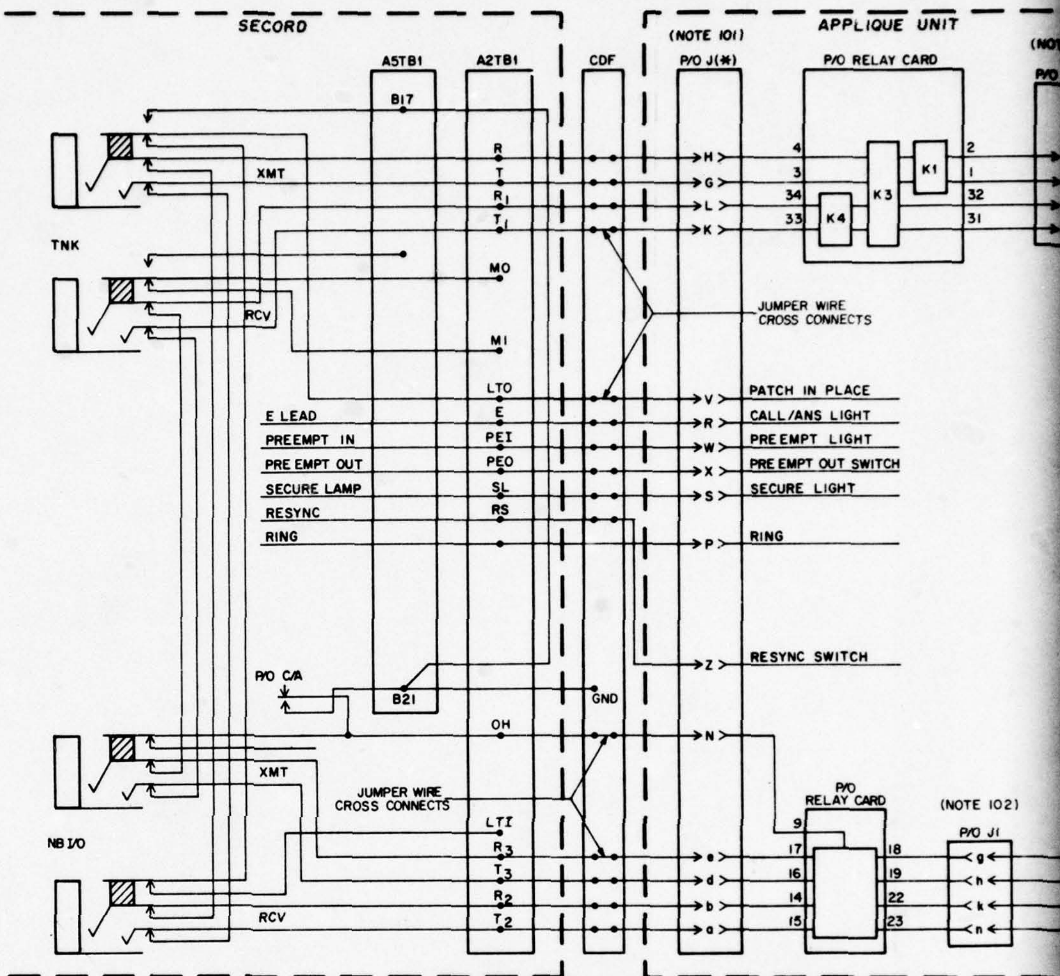
LIST OF MATERIALS

IDENT NO. STD-SV-0016		ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE	DATE DEC 78	WBSVNEP MODEM EQUIPMENT
DRAWN BY L. H. LEE	DEC 78	
CHECKED BY F.E. MYERS, JR.	DEC 78	
APPROVAL	ACTIVITY CCC-CED-SEP	SIZE D · FSCM NO. 50470 · DRAWING NO.
PROJECT		SCALE NONE · SHEET 1 OF 1

5	4	3	2	1

8 7 6 5

D



C

FIGURE 1

SECORD SWBD/APPLIQUE INTERCONNECT

B

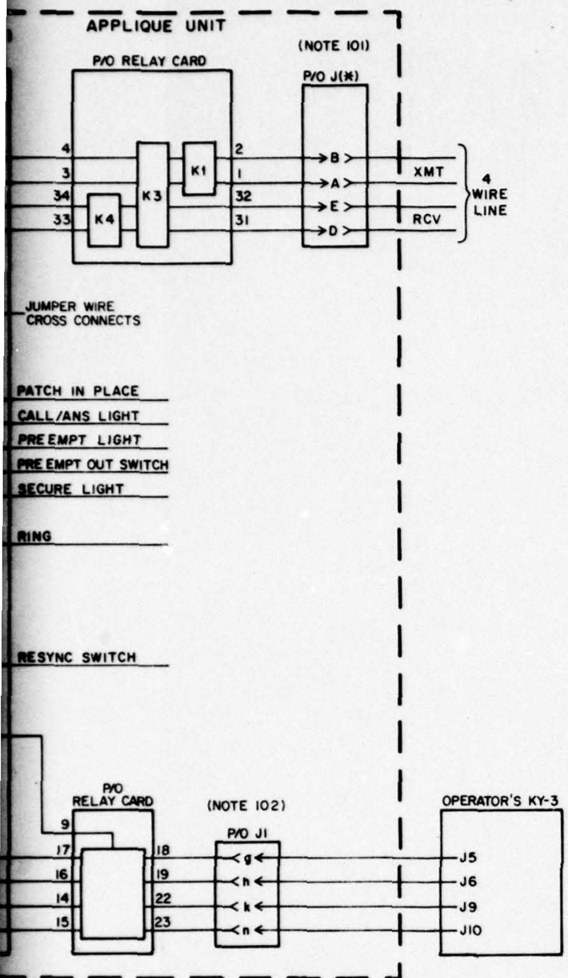
FROM		USE	TO				
WIDEBAND APPLIQUE UNIT							
DESIGNATION	TERMINAL		RADIO CIRCUIT				
4 WIRE LINE TRANSMIT	A	T	SEND				
	B	R					
4 WIRE LINE RECEIVE	D	T	RECEIVE				
	E	R					
			SECORD SWITCHBOARD TERMINALS				
			TRUNK #1	TRUNK #2	TRUNK #3	TRUNK #4	TRUNK #5
SWITCHBOARD LINE TRANSMIT	G	T	G20	C21	L23	G24	C25
	H	R	H20	D21	M23	H24	D25
SWITCHBOARD LINE RECEIVE	K	T_1	E20	A21	J23	E24	A25
	L	R_1	F20	B21	K23	F24	B25
CALL/ANSWER SWITCH	N	OH	M15	M16	M17	M18	M19
RING	P	RING	L14	M14	K13	L13	M13
CALL/ANSWER LIGHT	R	E	F15	F16	F17	F18	F19
SECURE LIGHT	S	SL	C15	C16	C17	C18	C19
PATCH IN PLACE	V	LTO	J15	J16	J17	J18	J19
PRE EMPT LIGHT	W	PEI	E15	E16	E17	E18	E19
PREEMPT OUT SWITCH	X	PEO	D15	D16	D17	D18	D19
RESYNC SWITCH	Z	RS	A15	A16	A17	A18	A19
NB IN/OUT RECEIVE	a	T_2	A20	J22	E23	A24	J26
	b	R_2	B20	K22	F23	B24	K26
NB IN/OUT TRANSMIT	d	T_3	C20	L22	G23	C24	L26
	e	R_3	D20	M22	H23	D24	M26
			OPERATOR'S KY-3				
TRANSMIT	g	T	J5	SEND			
	h	R	J6				
RECEIVE	k	T	J9	RECEIVE			
	n	R	J10				

A

TABLE 1

SECORD SWBD TERMINAL BLOCK ASSIGNMENTS

8 7 6 5



ZONE	REV	DESCRIPTION	DATE	APPROVED

NOTES:

101. J-1 ON THE WIDEBAND APPLIQUE UNIT IS TRUNK 1; J-2 IS TRUNK 2; AND J-3 IS TRUNK 3.

102. THE OPERATOR'S KY-3 IS CONNECTED TO TERMINALS g, h, k, AND n OF J-1 ONLY. IF A SECOND APPLIQUE UNIT IS USED (FOR TRUNKS 4 AND 5), THESE FOUR TERMINALS MUST BE CONNECTED IN PARALLEL WITH THE SAME TERMINALS ON J-1 OF THE SECOND APPLIQUE UNIT.

103. SEE DRAWING STD-SV-0006, SHEET 2, FOR WIDEBAND APPLIQUE J-1, J-2, AND J-3 PIN LOCATION DIAGRAM.

104. THE SECORD A2TB1 PIN DESIGNATIONS ARE AS FOLLOWS: THE LETTER IS THE PIN (A THROUGH M, HORIZONTALLY) AND THE NUMBER IS THE ROW (VERTICALLY): FOR EXAMPLE, D16 IS PIN D ON ROW 16. SEE FIGURE 2-1, TM 11-5805-486-15.

105. ONE RUN OF EACH BOM ITEM (128 AND 129) MAY BE USED OR IF AVAILABLE A LARGER CABLE MAY BE SELECTED FOR OPERATION OF THREE OR MORE TRUNKS.

106. THE SECORD SWITCHBOARD INSTALLATION IS NOT INCLUDED IN THIS SEIP. THIS BOM UTILIZATION DATA IS BASED ON VOICE/DATA LINES AND CONTROL LINES BEING TERMINATED ON SEPARATE CDF BLOCKS.

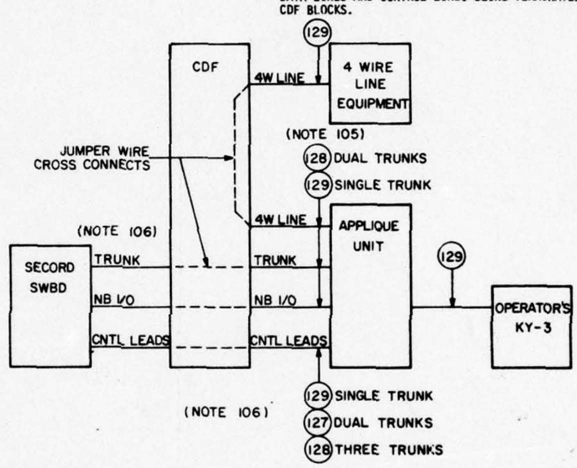


FIGURE 2

APPLIQUE UNIT CABLE BOM USAGE

NNECT

TO		
CIRCUIT		
OARD TERMINALS		
NK #3	TRUNK #4	TRUNK #5
23	G24	C25
23	H24	D25
23	E24	A25
23	F24	B25
17	M18	M19
K13	L13	M13
F17	F18	F19
C17	C18	C19
J17	J18	J19
E17	E18	E19
D17	D18	D19
A17	A18	A19
23	A24	J26
23	B24	K26
23	C24	L26
23	D24	M26
OR'S KY-3		

MENTS

ITEM	AEL	DESCRIPTION	NSN	UI	QTY

LIST OF MATERIALS

IDENT NO. STD-SV-0017	ORGANIZATION US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY C. McKASKLE, DATE DEC 78; DRAWN BY L.H. LEE, DEC 78; CHECKED BY F.E. MYERS, JR, DEC 78	WBSVNEP WIDEBAND SECURE VOICE APPLIQUE UNIT INTERFACE
APPROVAL H.M. Solis; ACTIVITY CCC-CED-SEP; PROJECT	SIZE D; FSCM NO. 50470; DRAWING NO.
	SCALE NONE; SHEET 1 OF 1

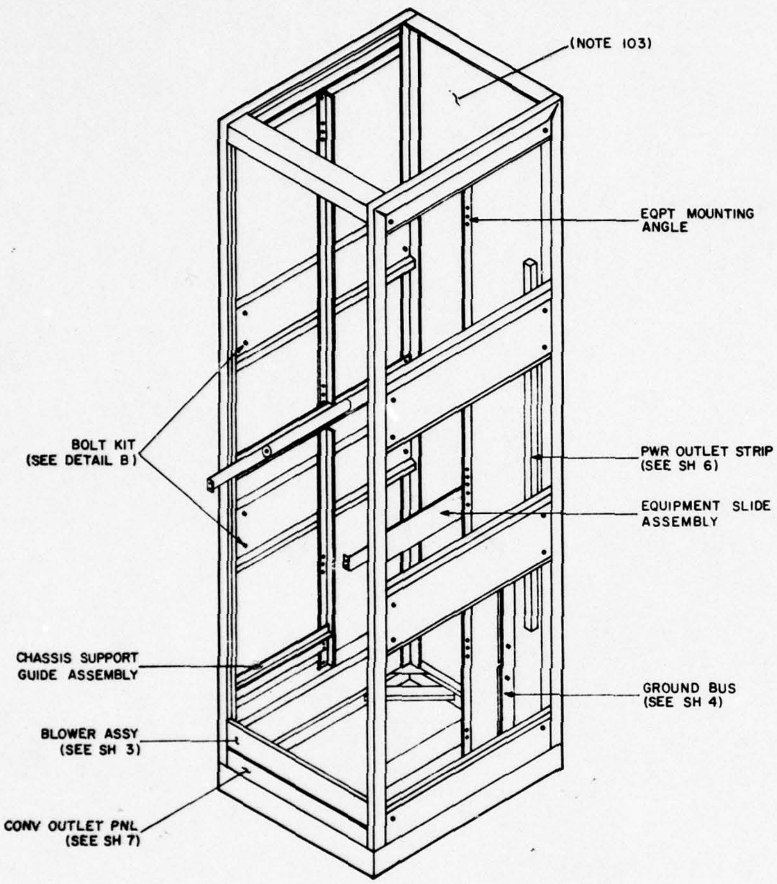
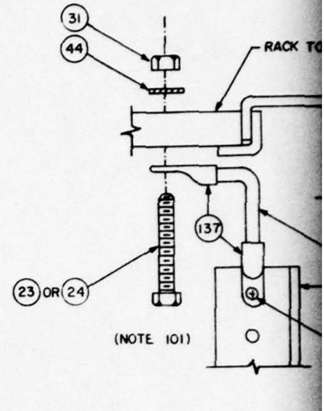


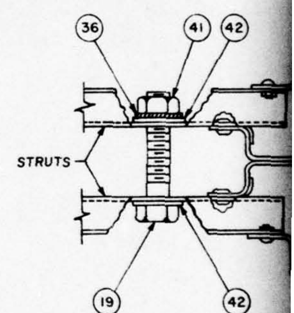
FIGURE 1

EQUIPMENT RACK ASSEMBLY



DETAIL A

GROUND STRA



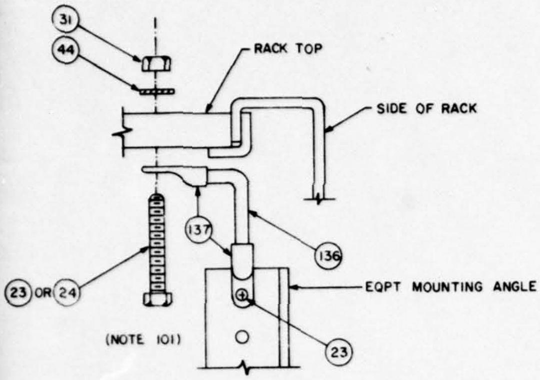
DETAIL B

BOLT KIT

ZONE	REV	DESCRIPTION	DATE	APPROVED

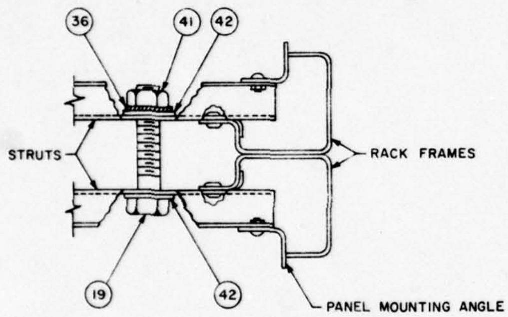
REVISION

2



DETAIL A

GROUND STRAP



DETAIL B

BOLT KIT

NOTES:

101. BRASS CAP SCREW (BOM 24) IS USED WITH CABINETS WHICH HAVE PLASTIC TOP PANELS (BOM 103) AND BRASS MACHINE SCREW (BOM 23) IS USED WITH METAL TOP PANELS (BOM ITEMS 54 AND 135).

102. SEE EQUIPMENT RACK ELEVATION DRAWINGS STD-SV-0013 (CONVERTERS) AND STD-SV-0014 (EARTH TERMINAL) FOR EQUIPMENT LOCATION.

103. SEE SHEET 8 FOR TOP PANEL DETAILS.

ITEM	AEL	DESCRIPTION	NSN	UI	QTY
60	10098Z	RECEPTACLE, AC PWR, DOUBLE OUTLET	5935-00-283-4003	EA	
57	19656J	SWITCH BOX, ELEC 2-1/2 IN DEEP, 3 IN LG X 2 IN WD	5930-00-J01-4011	EA	
56	19547Z	RETRACTOR, CABLE, STEEL, 15 IN LG MAIN ARM W/SPRING-LOADED MTG BRACKET	5840-00-982-4465	EA	
54	21301E	PANEL, CLOSURE, PLAIN, 19 IN X 12-1/4 IN 16 GAGE COLD-ROLLED STEEL	5805-00-J01-6263	EA	
45	19711J	NUT, KEPS, 10-32 THD, W/LOCKWASHER EMCOR AHWX-102-003219	5310-00-J01-3650	EA	
44	19635Z	WASHER, LOCK, EXTERNAL TEETH, BRASS, 0.256 IN ID	5310-00-942-5109	HD	
43	07485Y	NUT, HEX, STEEL 10-32 THD, CD PLTD	5310-00-934-9751	HD	
42	19249K	WASHER, FLAT, ROUND, STEEL, 3/8 IN ID	5310-00-595-6057	EA	
41	19628D	NUT, HEX, STEEL, 3/8-16 THD	5310-00-551-7739	EA	
38	17597L	NUT, CLIP, STEEL, 10-32 THD EMCOR NO AHWX-092-003219	5310-00-454-0542	EA	
37	10287B	WASHER, LOCK, SPLIT HELICAL RING, STEEL, 0.25 IN ID	5310-00-262-3562	HD	
36	19193L	WASHER, LOCK, EXT TEETH, STEEL 0.384 IN ID	5310-00-209-0790	HD	
35	19655K	WASHER, LOCK, INTERNAL TEETH, STEEL 0.195 IN ID	5310-00-193-7486	HD	
34	00488D	WASHER, FLAT, ROUND, STEEL, NO. 10	5310-00-167-0834	HD	
31	19637B	NUT, HEX, BRASS, 1/4-20 THD SIZE	5310-00-012-3190	EA	
29	10292M	SCREW, MACH, PAN HEAD, STEEL, 10-32 THD X 5/8 IN LG	5305-00-989-7435	HD	
28	00337G	SCREW, MACH, PAN HEAD, STEEL, 10-32 THD x 1/2 IN LG	5305-00-989-7434	HD	
26	19640Y	SCREW, CAP, HEX HEAD, BRASS, 1/4-20 X 5/8 IN LG	5305-00-935-7581	EA	
25	19633K	SCREW, MACH, EXTENDED WASHER HEAD, 10-32, THD X 1/2 IN LG	5305-00-740-5076	EA	
24	21346F	SCREW, CAP, HEX HEAD, BRASS, 1/4-20 THD X 1-1/2 IN O/A LG	5305-00-558-7182	EA	
23	19634J	SCREW, MACH, PAN HEAD, BRASS 1/4-20 THD X 7/8 IN LG	5305-00-206-8152	EA	
22	09573Q	SCREW, MACH, ORNAMENTAL HEAD, 10-32 X 1-1/8 IN LG	5305-00-085-3044	HD	
21	19639D	SCREW, CAP, HEX HEAD, STEEL 1/4-20 X 1/2 IN LG	5305-00-068-0500	HD	
19	19179N	SCREW, CAP, HEX HEAD, STEEL 3/8-16 THD X 1-1/2 IN LG	5305-00-021-3740	EA	
18	19649C	FILTER, AIR, REPLACEMENT FOR BLOWER, BUD #BF-24	4130-01-013-9008	EA	
10	19647A	SHELF, RETRACTABLE, EQUIPMENT RACK, 19 IN WD X 29-13/16 IN DEEP	7125-00-J01-3695	EA	
6	19646Z	DRAWER, EQUIPMENT RACK, 19 IN WD X 3-1/2 IN H	5895-00-J01-3717	EA	
1	19648B	BLOWER ASSEMBLY, RACK MTD W/FILTER	4140-00-270-6775	EA	

LIST OF MATERIALS

IDENT NO: STD-MS-0017	ORGANIZATION: US ARMY COMMUNICATIONS-ELECTRONICS ENGINEERING INSTALLATION AGENCY
DESIGN BY: C. McKASKLE — DATE: DEC 78	WBSVNEP TYPICAL EQUIPMENT RACK ASSEMBLY DETAILS
DRAWN BY: L. H. LEE — DEC 78	
CHECKED BY: F. E. MYERS, JR. — DEC 78	
APPROVAL: [signature] — ACTIVITY: CCC-CED-[illegible] — PROJECT	SIZE: D — FSCM NO: 50470 — DRAWING NO:
	SCALE: NONE — [illegible] — SHEET 1 OF 8

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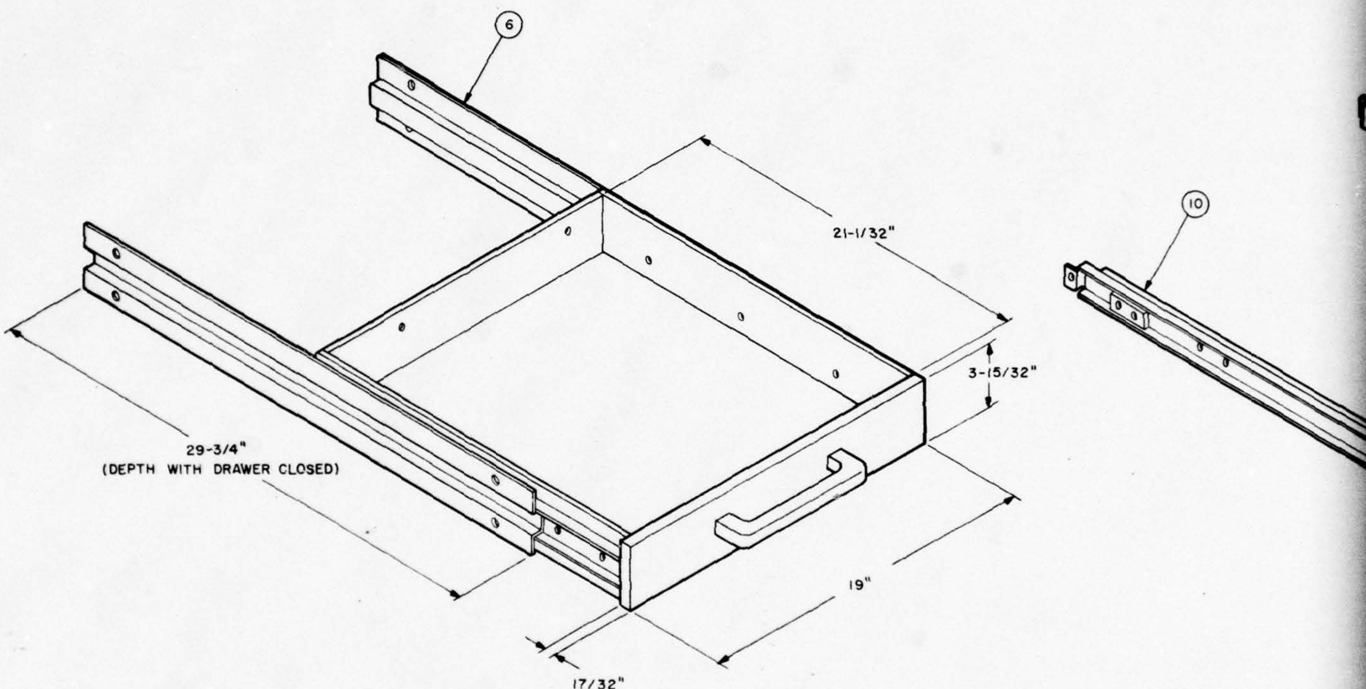

FIGURE 2

STORAGE DRAWER ASSEMBLY

ZONE	REV	DESCRIPTION	DATE	APPROVED
REVISION				

2

NOTES:

201. HARDWARE KIT WITH ALL REQUIRED FASTENING DEVICES IS SUPPLIED WITH UNIT.

202. RETRACTABLE SHELF HAS LOAD CAPACITY OF 50 LBS, AND DRAWER HAS CAPACITY OF 90 LBS.

203. IF SHELF IS INSTALLED IN RACK EQUIPPED WITH REAR MOUNTING ANGLES, NOTCH THE MOUNTING ANGLE TO ALLOW FOR CLEARANCE OF RETRACTABLE SHELF ASSEMBLY MOUNTING BRACKET OR CUT RETRACTOR SLIDE TO REQUIRED LENGTH.

204. IF DRAWER IS INSTALLED IN RACK EQUIPPED WITH REAR MOUNTING ANGLES, CUT DRAWER SLIDE MOUNTING BRACKET TO REQUIRED LENGTH.

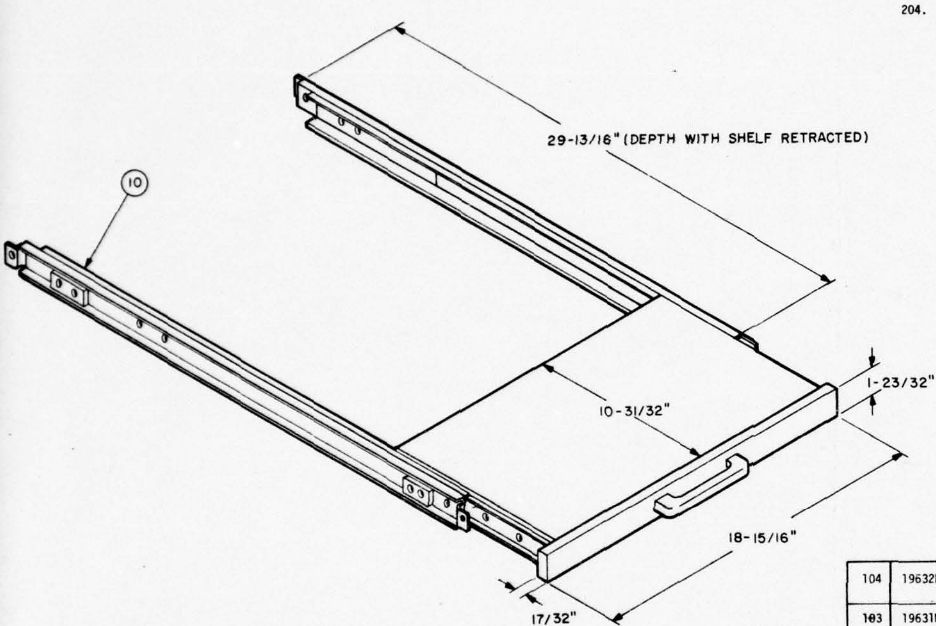

FIGURE 3

RETRACTABLE SHELF ASSEMBLY

ITEM	AEL	DESCRIPTION	NSN	UI	QTY
104	19632L	VENT GRILLE, 19 IN X 7 IN, CLEAR ANODIZED ALUMINUM MATL	5975-00-J01-3713	EA	
103	19631M	PANEL, CLOSURE, PLAIN, 19 IN X 19-1/4 IN X 5/8 IN, PLASTIC	5975-00-J01-3697	EA	
102	08677K	CABLE TIE, 0.301 IN W, 13.38 IN LG, BLACK COLOR	5975-00-985-6630	HD	
101	00879Z	PANEL, BLANK, 19 IN X 1-3/4 IN, ALUMINUM	5975-00-937-4583	EA	
95	19548A	PANEL, BLANK, 19 IN X 3-1/2 IN H, ALUMINUM	5975-00-685-9538	EA	
94	19657Z	BOX CONNECTOR, IRON OR STEEL MATL 0.688 IN MAX CABLE OPENING	5975-00-682-0461	EA	
92	13789F	ENTRANCE END FTG, F/U/W 3/4 IN X 1-9/32 IN DUCT	5975-00-673-7658	EA	
90	21339Z	DUCT, COVER, STR 7/8 IN X 1-1/4 IN X 5 FT, STEEL, BUFF	5975-00-378-5313	FT	
89	19652N	DUCT, BASE, STR 7/8 IN X 1-1/4 IN X 10 FT, STEEL, BUFF	5975-00-284-6755	EA	
88	02515G	JUNCTION BOX, STEEL MATL, 4 IN LG X 2.125 IN W X 2.125 IN DEEP	5975-00-284-5827	EA	
87	03056K	ENTRANCE END FTG, F/U/W 7/8 L X 1-1/4 IN DUCT	5975-00-244-7806	EA	
86	02397J	COVER, JUNCTION BOX, DUPLEX, STEEL, 4 IN LG X 2.125 IN W	5975-00-188-1164	EA	
85	19729F	COVER PLATE, DUPLEX, ELEC OUTLET 4.5 IN LG X 2.75 IN WD	5975-00-097-8511	EA	
83	19556K	STANDOFF, PHENOLIC, 1/4-20 THD HEX, 1/2 IN DIA	5970-00-J01-3972	EA	
65	19654L	RECEPTACLE, AC PWR, SINGLE OUTLET W/GND 15A, 125V	5935-00-813-0620	EA	
63	08256N	POWER STRIP, 12 OUTLETS, 3-WIRE CKT PART #20GB606	5935-00-509-2644	EA	

LIST OF MATERIALS, CONT'D

IDENT NO: STD-MS-0017	SIZE: D	FSCM NO: 50470	DRAWING NO:
DRAWN BY: G. VERDI			
APPROVED: H. M. Soles	SCALE: NONE	ENTERED IN CADCEIA	SHEET 2 OF 8

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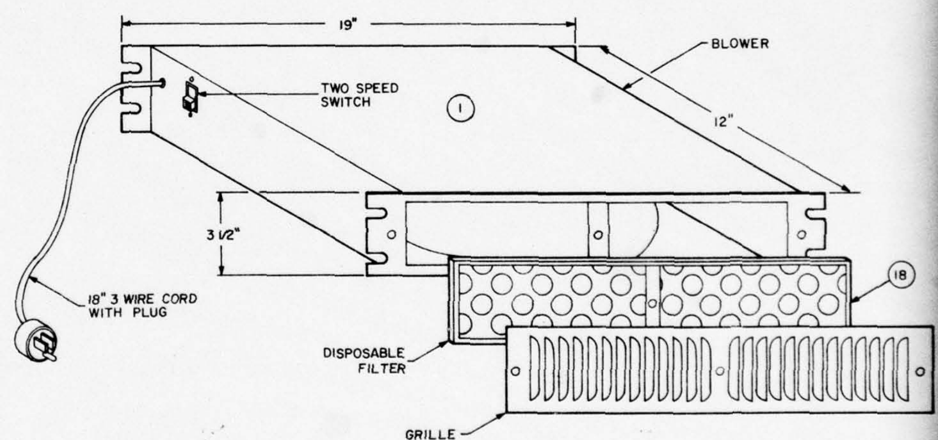
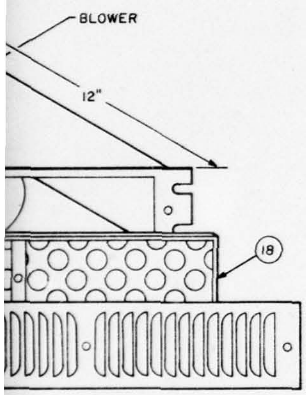


FIGURE 4

BLOWER UNIT

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2



ITEM	AEL	DESCRIPTION	NSN	UI	QTY
136	21652D	WIRE, ELEC, 6 AWG, TW, STRANDED YELLOW COLOR	NSNR	FT	
135	22319A	PANEL, CLOSURE, PLAIN, 19 IN X 7 IN 16 GAGE STEEL, EMCOR PN-7 OR EQUAL	NSNR	EA	
133	06959G	BUS BAR, COPPER, 1/4 IN THK, 1 IN WD	9530-00-277-8552	FT	
124	03616H	CABLE, POWER, 3-COND, 12 AWG GALVANIZED STEEL ARMOR COVERING	6145-00-635-4603	CL	
119	03538G	WIRE, ELEC, 10 AWG, SOLID COND, BLACK	6145-00-191-2575	FT	
117	05285Y	WIRE, ELEC, 10 AWG, SOLID COND, GREEN	6145-00-191-2569	FT	
113	03507W	WIRE, ELEC, 10 AWG, SOLID COND, WHITE	6145-00-184-5346	FT	
106	21338W	MOUNTING ANGLE, PANEL ADJ, 70 IN LG	5975-00-J01-3721	EA	
105	19627C	MOUNTING ANGLE, PANEL ADJ, 61 IN LG	5975-00-J01-3718	EA	

LIST OF MATERIALS, CONT'D

IDENT NO. STD-MS-0017	SIZE D	FSCM NO. 50470	DRAWING NO.
DRAWN BY L. H. LEE			
APPROVED [signature]	SCALE NONE	ENTERED IN [illegible]	SHEET 3 OF 8

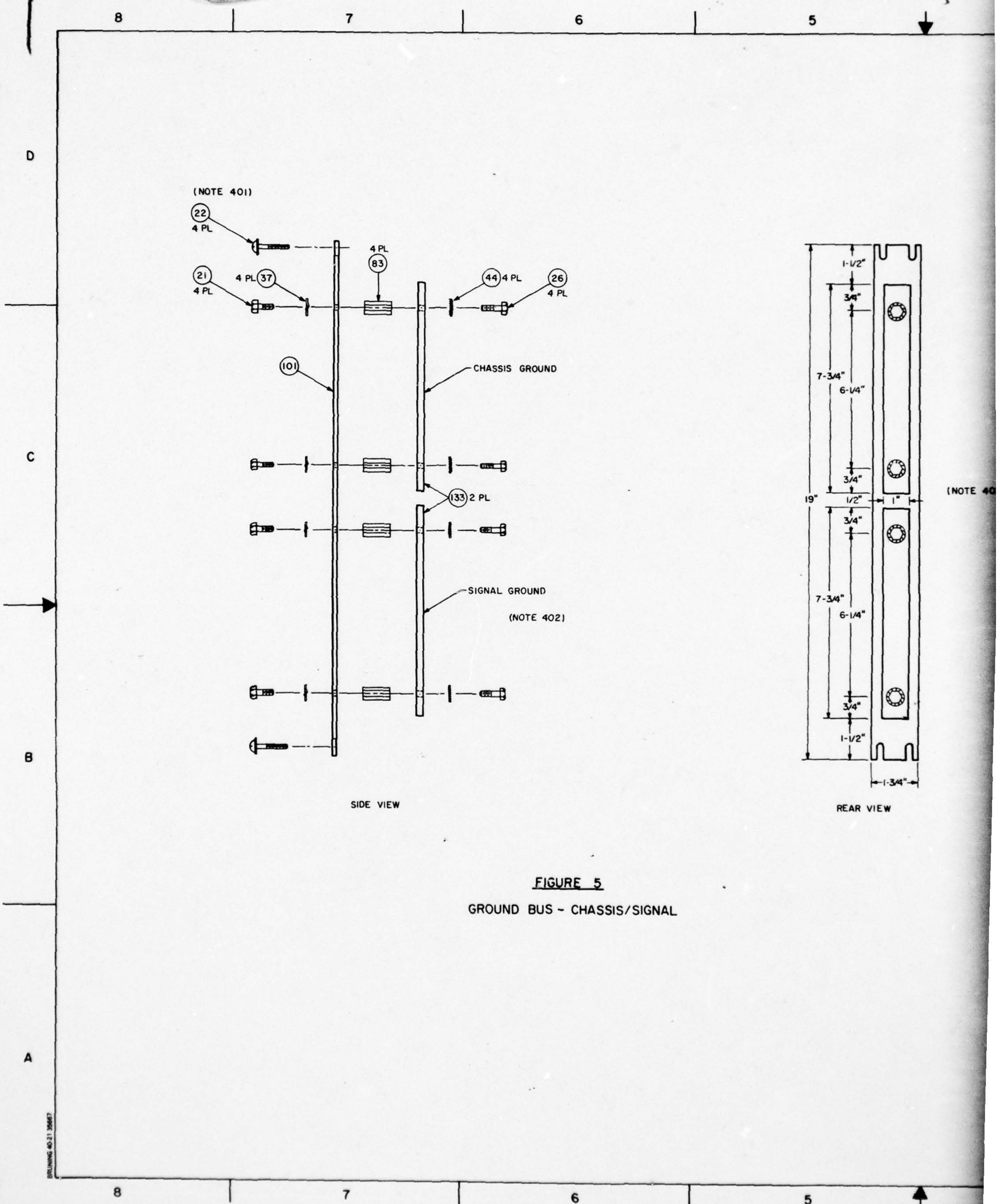


FIGURE 5

GROUND BUS - CHASSIS/SIGNAL

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2

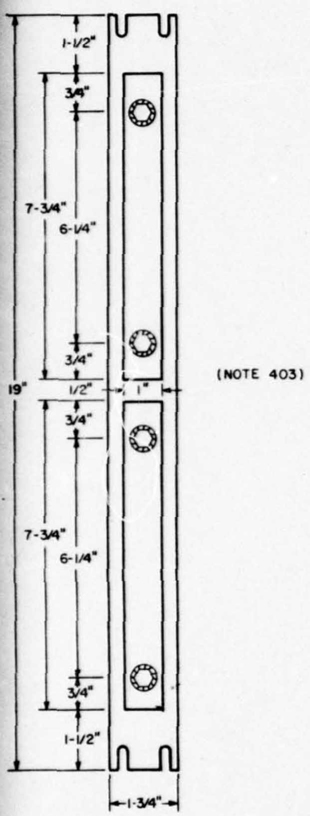
NOTES:

401. MACHINE SCREWS (BOM 22) AND CLIP NUTS (BOM 38) ARE USED FOR SECURING THE GROUND BUS BAR TO THE CABINET.

402. AFTER ASSEMBLY, MEASUREMENTS SHALL BE MADE TO INSURE THAT BOTH COPPER BARS ARE INSULATED FROM THE ALUMINUM PANEL.

403. IN THE EVENT THAT BOTH CHASSIS AND SIGNAL GROUNDS ARE NOT REQUIRED IN A PARTICULAR EQUIPMENT CABINET, THE TWO BUS BARS MAY BE STRAPPED TO PROVIDE ADDITIONAL GROUNDING CAPABILITY.

404. COPPER BUS BARS SHALL BE DRILLED AND TAPPED TO SUPPORT THE PARTICULAR GROUNDING REQUIREMENTS.



REAR VIEW

IDENT NO STD-MS-0017	SIZE D	FSCM NO 50470	DRAWING NO.
DRAWN BY L. H. LEE			
APPROVED Hon Solon	SCALE NONE		SHEET 4 OF 8

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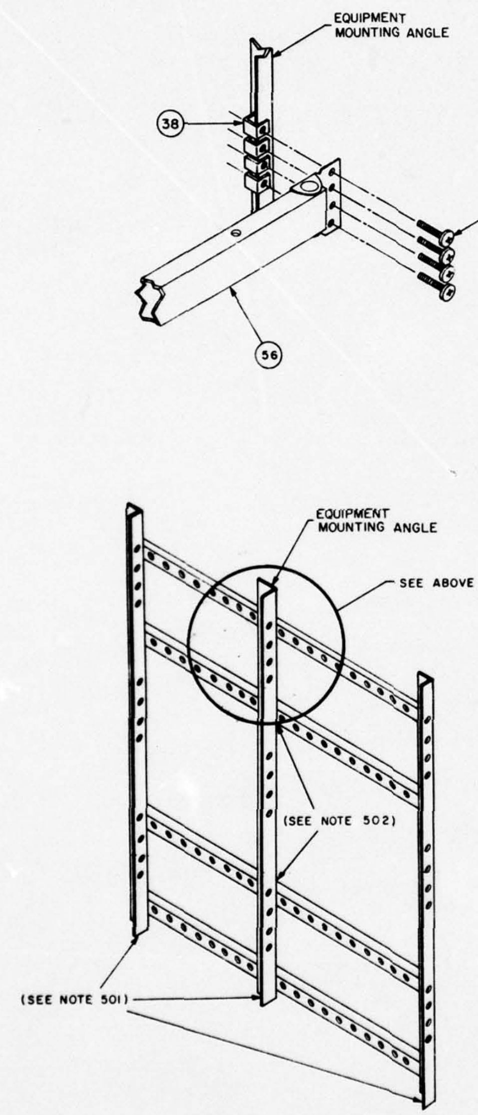
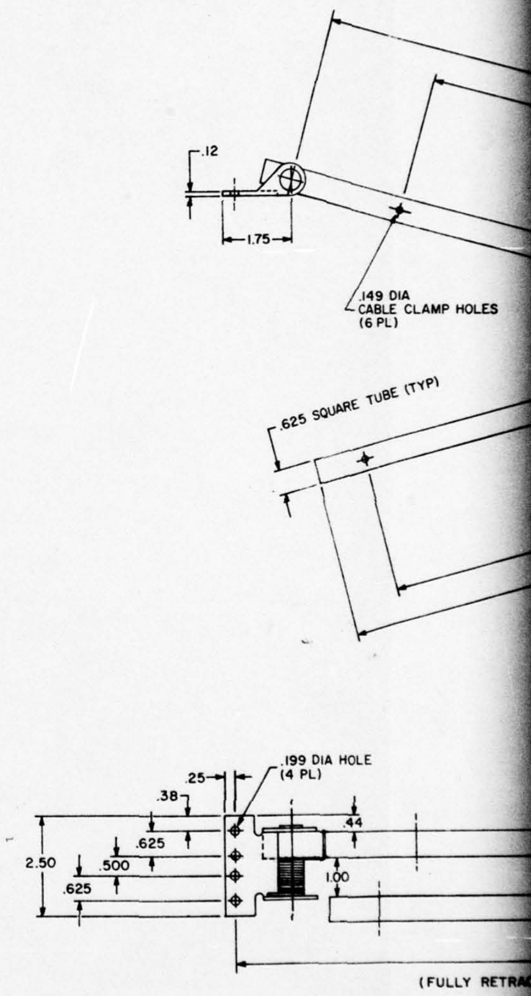


<u>FIGURE 6</u>

EQUIPMENT ANGLE AND RETRACTOR MOUNTING

N.T.S.



CABL

BRUNING 40-21 35687

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2

NOTES:

501. THE EQUIPMENT MOUNTING ANGLES (BOM 105 OR 106) ARE SELECTED TO FIT THE PARTICULAR CABINET HEIGHT.

502. PAN HEAD SCREWS (BOM 29) AND CLIP NUTS (BOM 38) ARE USED FOR SECURING THE EQUIPMENT MOUNTING ANGLES TO THE CABINET.

503. SIGNAL AND POWER CABLES ARE SECURED TO THE ARMS OF THE CABLE RETRACTOR USING BOM ITEM 102.

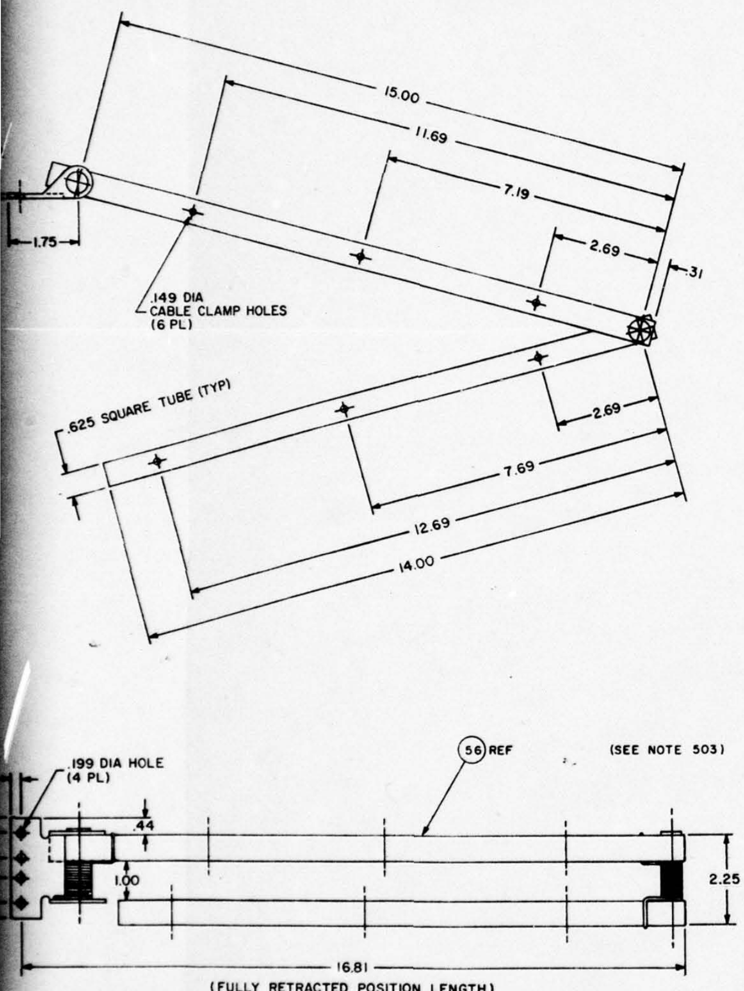


FIGURE 7

CABLE RETRACTOR

SCALE: 1/2"=1"

IDENT NO. STD-MS-0017	SIZE D	FSCM NO. 50470	DRAWING NO.
DRAWN BY L. H. LEE			
APPROVED	SCALE NOTED	ENTERED IN USABRELA	SHEET 5 OF 8

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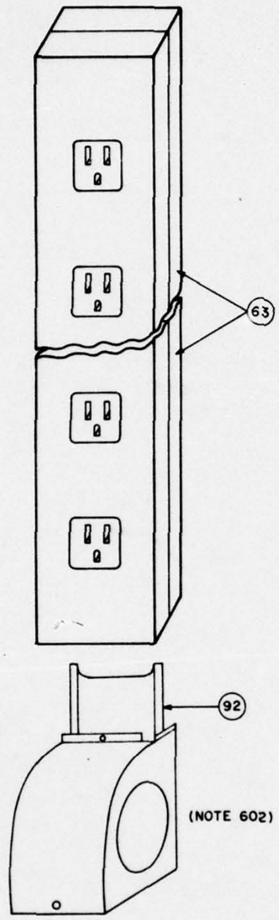
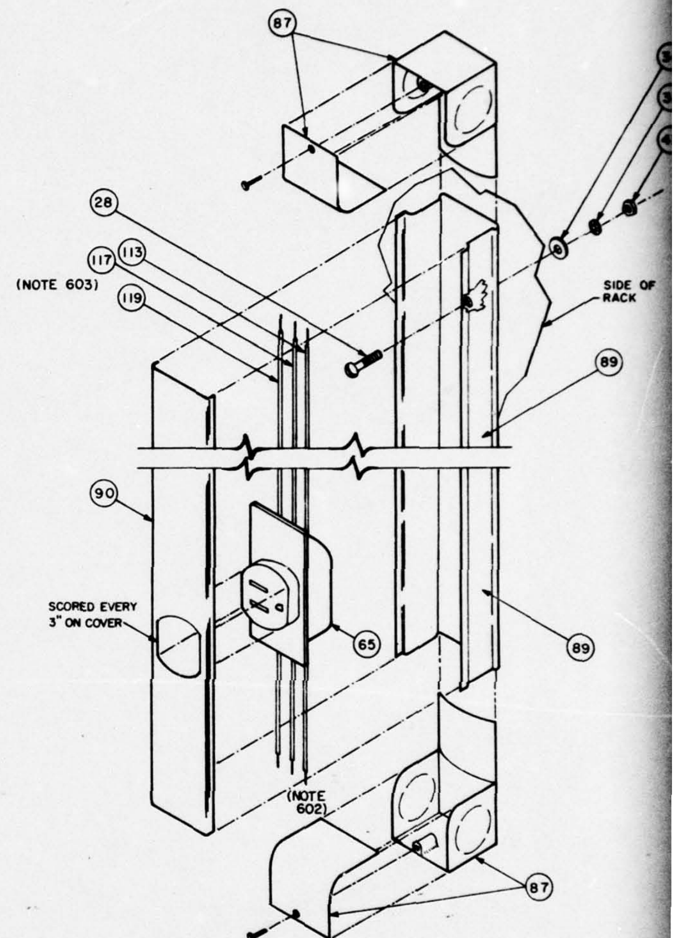


15 AMP STRIP



30 AMP STRIP

FIGURE 8

POWER STRIPS

(NOTE 601)

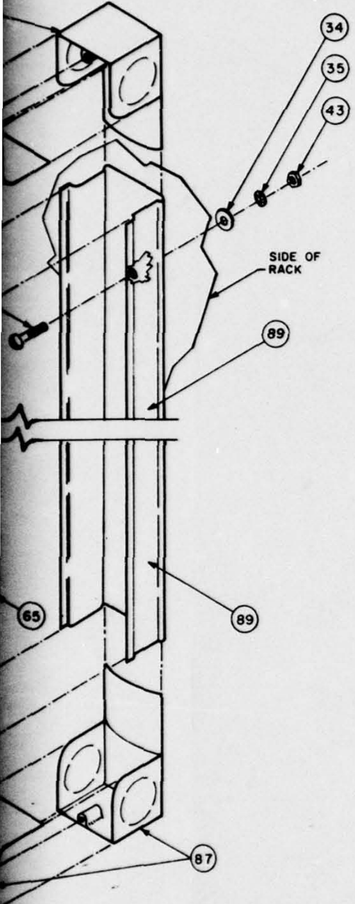
5 4 3 2 1

REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

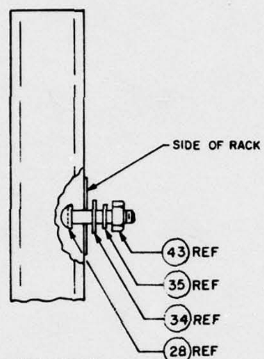
NOTES:

601. ONE POWER STRIP SHALL BE INSTALLED IN EACH EQUIPMENT RACK. THIS STRIP SHALL BE SELECTED TO SATISFY EQUIPMENT POWER REQUIREMENTS FOR THAT PARTICULAR RACK.

602. THIS POWER STRIP SHALL BE CONNECTED TO STATION CRITICAL POWER, IF AVAILABLE.



MP STRIP



SIDE VIEW

IDENT NO. STD-MS-0017	SIZE D	FSCM NO. 50470	DRAWING NO.	
DRAWN BY L.H. LEE				
APPROVED	SCALE NONE			SHEET 6 OF 8

5 4 3 2 1

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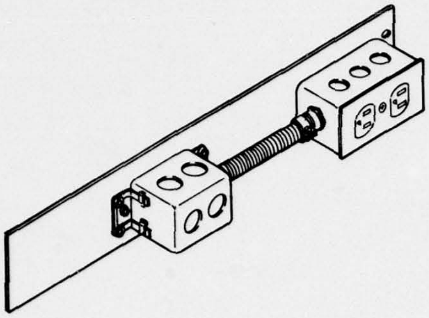


REAR VIEW (ASSEMBLED)

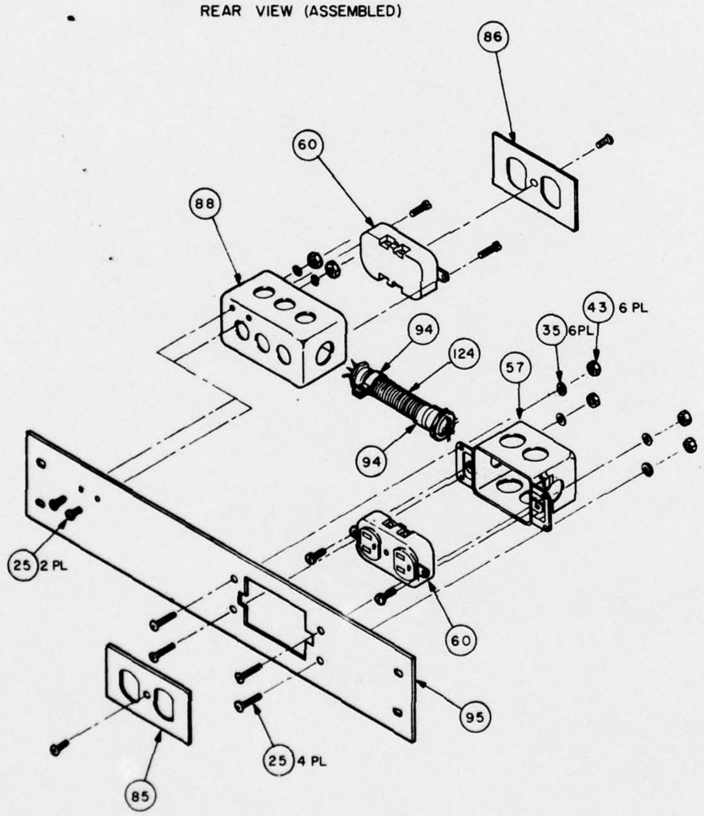
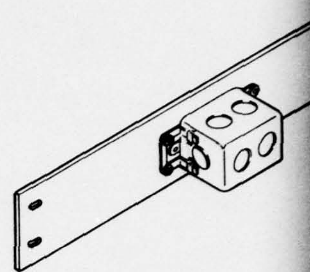
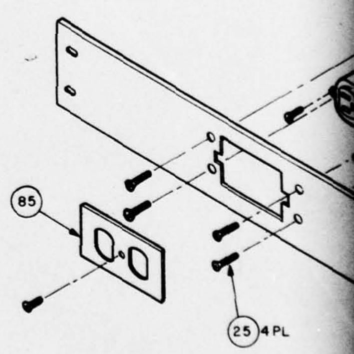


FIGURE 9
EXTERNAL / INTERNAL ACCESS



REAR VIEW (AS



FIGURE

EXTERNAL

BRUNING 40-21 35467

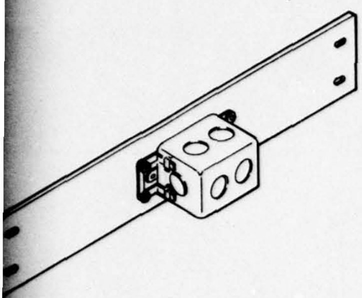
REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

2

NOTES:

701. CONVENIENCE OUTLET ASSEMBLIES ARE SELECTED AS REQUIRED. THE DUAL ACCESS (EXTERNAL/INTERNAL) UNIT IS USED IN RACKS WHICH CONTAIN A BLOWER ASSEMBLY (BOM 1). OTHER RACKS WHICH REQUIRE A CONVENIENCE OUTLET SHALL USE THE EXTERNAL ACCESS UNIT.

702. THE CONVENIENCE OUTLET SHALL BE CONNECTED TO NON-CRITICAL POWER SOURCE.



REAR VIEW (ASSEMBLED)

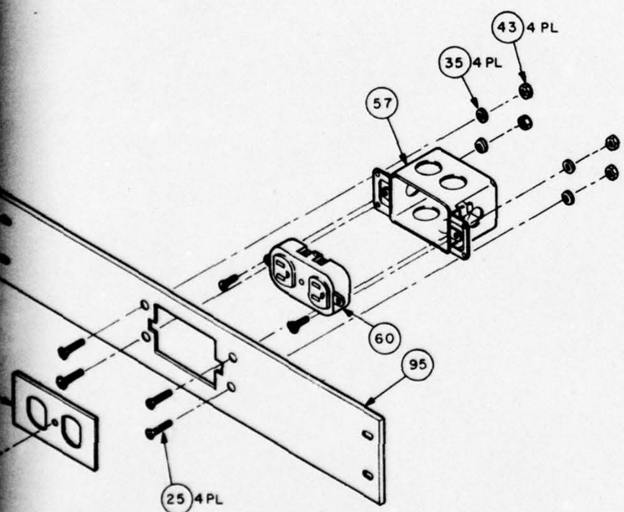


FIGURE 10

EXTERNAL ACCESS

IDENT NO.	SIZE	FSCM NO.	DRAWING NO.
STD-MS-0017	D		
DRAWN BY G. VERDI			
APPROVED Hm Solin	SCALE NONE	ENTERED IN USACEEIA EDS	SHEET 7 OF 8

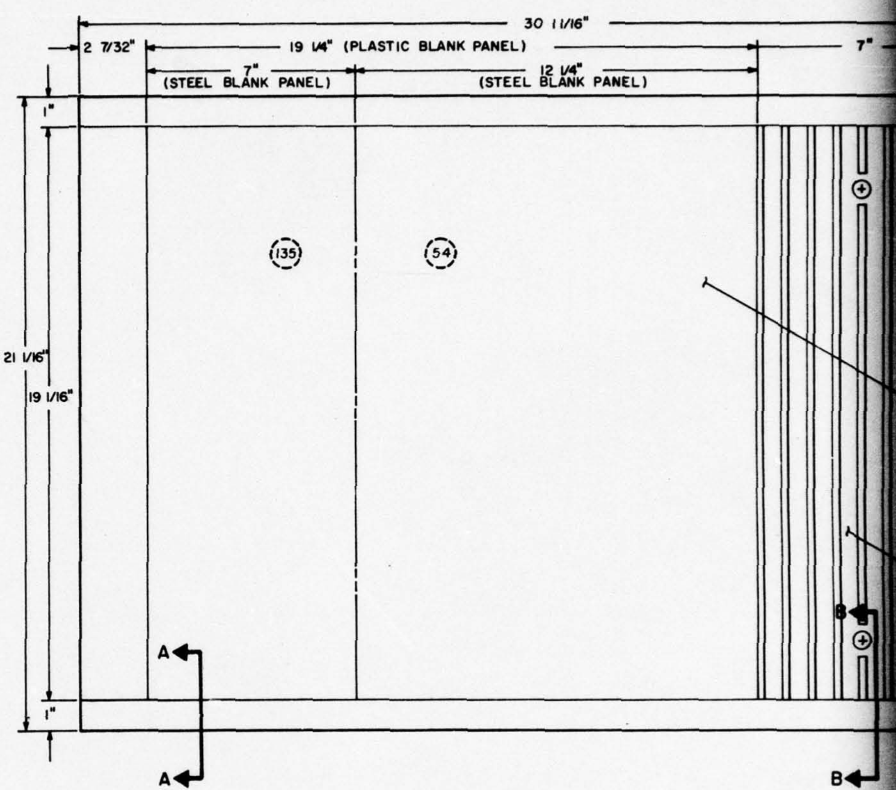
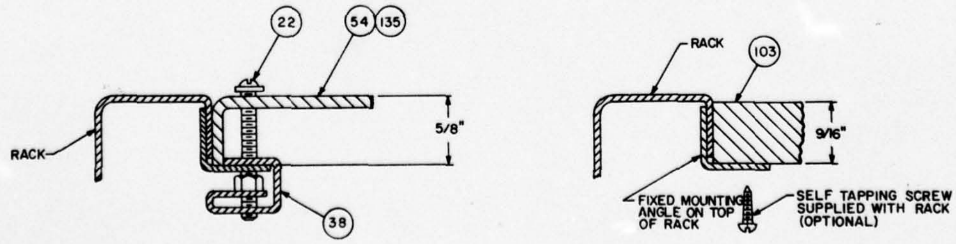


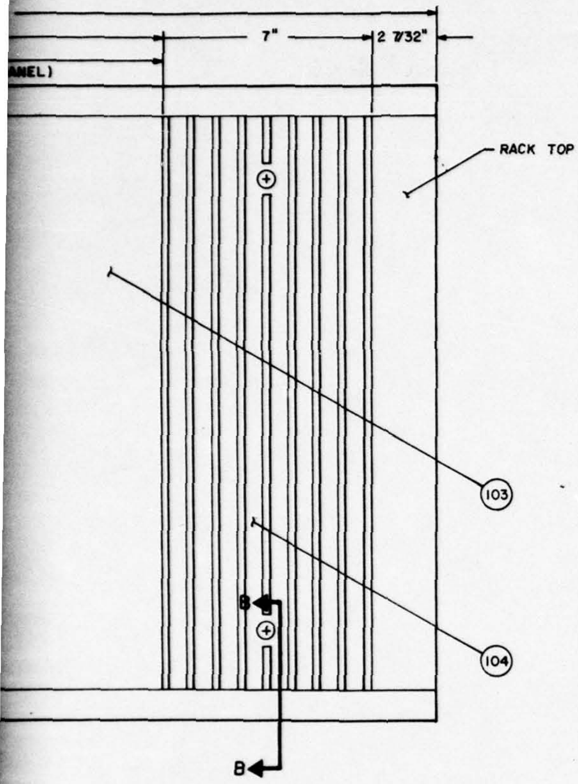
FIGURE 11
RACK TOP PANEL



STEEL

PLASTIC

SECTION A-A
BLANK PANEL

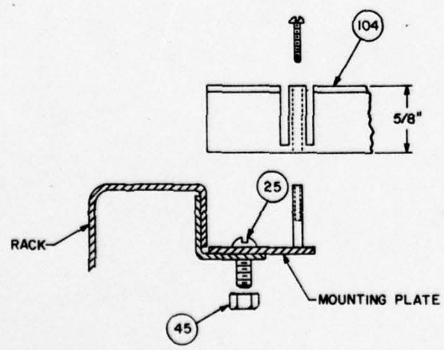


REVISION				
ZONE	REV	DESCRIPTION	DATE	APPROVED

NOTES:

801. EQUIPMENT RACK TOP PANELS MUST SATISFY EQUIPMENT VENTILATION REQUIREMENTS.

802. INSTALLATIONS WITH OVERHEAD GROUND SYSTEMS MAY REQUIRE A GROUND WIRE ENTRANCE THROUGH THE TOP.



SECTION B-B

VENT GRILLE

IDENT NO. STD-MS-0017	SIZE D	FSCM NO. 50470	DRAWING NO.	
DRAWN BY L. H. LEE				
APPROVED H.M. Solis	SCALE NONE		ENTERED IN USACEEIA	SHEET 8 OF 8

SECTION 5. BILL OF MATERIALS

5.1 GENERAL. This section contains the bill of materials (BOM), figure 5-1, used in a typical wideband secure voice network extension project. The BOM is divided into two major categories: (1) Major Items and Assemblies (BOM items 1 through 13), and (2) Individual Item Listing (BOM items 14 through 137).

5.1.1 BOM Numbering. The BOM number used on the drawings is the same as the assigned BOM number. The Individual Item Listing has an additional column indicating the associated major assembly item listed in table 5-1. Table 5-1 provides a cross-reference letter indicating the major assembly where that individual item is used; for example, BOM item 18 is "Filter, Air" used on Major Item A, which is the blower assembly shown on drawing STD-MS-0017, sheet 3 of 8. The filter on that drawing is identified as BOM #18, thus retaining only one BOM number for each item throughout this SEIP.

5.1.2 Sequence. The BOM is arranged with National Stock Number (NSN) and Management Control Number (MCN) items first by NSN and MCN number sequence. These are followed by non-NSN or non-MCN numbered items in Authorized Equipment List (AEL) number sequence, and then by nonnumbered items in alphabetical sequence. This arrangement is maintained within each of the two major categories.

5.2 BILL OF MATERIALS. The BOM contains USACC standard authorized materials which are to be used in the preparation of individual Engineering Installation Packages (EIPs). Requests for significant changes to the BOM will be submitted to Headquarters, USACEEIA, ATTN: CCC-CED-SEP, with justification for approval. Identification of items is primarily by NSN, MCN, and AEL number. When military identification numbers are not available, the manufacturer's part description and number (or catalog number) with approximate cost is provided. The number in parentheses in the Stock Number column is the AEL number.

Table 5-1. Major Assembly Item Cross-Reference List

Major item or assembly	Cross-reference letter
Blower assembly	A
Chassis support/guide assembly	B
Convenience outlet assembly	C
Converter, analog-digital, CV-3034/G and CV-3034A/G	D
Equipment slide mounting assembly	E
Frame assembly (equipment rack)	F
Ground bus assembly	G
Installation/miscellaneous hardware group	H
Modem, digital data, AN/USC-26	J
Modem, digital data (ICF), MD-920/G	K
Modem, digital data (PSK), MD-921/G	L
Multiplexer set, AN/GSC-24	M
Power strip (equipment rack)	N
Rack top panel/vent assembly	P
Wideband applique unit	Q

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION			UNIT IDENT CODE			
SEIP 035						
TELER NUMBER			DATE		PAGE NO.	NO. OF PAGES
WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT					1	13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
		MAJOR ITEMS AND ASSEMBLIES				
1	4140-00-270-6775 (19648B)	Blower Assembly, Rack Mounted, W/Filter; Drawing STD-MS-0017, Sheet 3	EA			
2	5805-00-221-2174 (15549F)	Converter, Analog-Digital, CV-3034/G	EA			
3	5805-01-018-4668 (18352P)	Converter, Analog-Digital, CV-3034A/G	EA			
4	5820-00-155-8576 (24140N)	Modem, Digital Data (ICF), MD-920/G	EA			
5	5820-00-155-8581 (18307C)	Modem, Digital Data (PSK), MD-921/G	EA			
6	5895-00-J01-3717 (19646Z)	Drawer, Equipment, Frame Mtg, 19" Wide, 3-1/2" High; Drawing STD-MS-0017, Sheet 2, Emcor No. DRA-3C-31	EA			
7	5895-00-J01-3729 (19624Z)	Frame Assembly, Electrical Equipment, 77-1/8" High, 30-3/4" Deep, 19" Rack Mtg, W/2 Side Panels; Drawing STD-MS-0017, Sheet 1, Emcor No. IE-53	EA			
8	5895-00-J01-3731 (19625A)	Frame Assembly, Electrical Equipment, 77-1/8" High, 30-3/4" Deep, 19" Rack Mtg, W/O Side Panels; Drawing STD-MS-0017, Sheet 1, Emcor No. IE-54 or Equal	EA			
9	5975-00-J01-3694 (19712Z)	Chassis Support/Guide Assembly; Fits Frames 25-1/2" or More in Depth, Guide Depth 23-9/16", Emcor No. CGS-25A or Equal	EA			
10	7125-00-J01-3695 (19647A)	Shelf, Retractable, Frame Mtg, 19" Wide, 29-13/16" Deep; Drawing STD-MS-0017, Sheet 2, Emcor No. RSA-1C-31	EA			

DA FORM 1 APR 78 3071-R EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials.

AD-A069 738 ARMY COMMUNICATIONS COMMAND FORT HUACHUCA AZ F/G 17/2

STANDARD ENGINEERING INSTALLATION PACKAGE. WIDEBAND SECURE VOIC--ETC(U)

MAY 79

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2 OF 4

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TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035				UNIT IDENT CODE			
TELEK NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT				DATE		PAGE NO. 2	NO. OF PAGES 13
ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
11	5805-01-016-7723 (18302K)	Modem, Digital Data, AN/USC-26		EA			
12	NSNR (21218Z)	Multiplexer Set, AN/GSC-24(V)		EA			
13	NSNR	Wideband Applique Unit		EA			
		INDIVIDUAL ITEM LISTING					
14	3439-00-260-1264 (00010J)	Flux, Soldering, Paste Form, Noncorrosive Type, 2-Oz Can; Use W/Tin-Lead Solder	H,Q	CAN			
15	3439-00-269-9610 (00011Z)	Solder, 60/40, 0.0625" Dia, 1-Lb Spool	H,Q	LB			
16	4020-00-231-5878 (00028F)	Twine, Lacing, 12-Ply, Linen, Spec MIL-C-2520A	H	LB			
17	4020-00-247-1737 (00033Z)	Twine, Veg Fiber, 12-Ply, 1-Lb Roll	H	LB			
18	4130-01-013-9008 (19649C)	Filter, Air, Replacement, Bud No. BF-24 or Equal	A	EA			
19	5305-00-021-3740 (19179N)	Screw, Cap, Hex Head, Steel, 3/8-16 Thd X 1-1/2" Lg (Used for Bolting Racks Together; 4 per Interior Joint)	F,H	EA			
20	5305-00-059-7056 (21345E)	Screw, Mach, Flat Countersunk Head, 10-32 Thd X 1-1/2" Lg, MS35193-61	E	EA			
21	5305-00-068-0500 (19639D)	Screw, Cap, Hex Head, Steel, 1/4-20 Thd X 1/2" Lg	G	HD			

DA FORM 1 APR 78 3071-R EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS
For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035

UNIT IDENT CODE:

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

DATE:

PAGE NO: 3

NO. OF PAGES: 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
22	5305-00-085-3044 (09573Q)	Screw, Mach, Ornamental Head, 10-32 Thd X 1-1/8" Lg, Emcor No. HW-103	F,G,H	HD			
23	5305-00-206-8152 (19634J)	Screw, Mach, Pan Head, Brass, 1/4-20 Thd X 7/8" Lg	H	EA			
24	5305-00-558-7182 (21346F)	Screw, Cap, Hex Head, Brass, 1/4-20 Thd (Thd 3/4" Lg) X 1-1/2" Lg	H	EA			
25	5305-00-740-5076 (19633K)	Screw, Mach, Extended Washer Head, 10-32 Thd X 1/2" Lg	C,H	EA			
26	5305-00-935-7581 (19640Y)	Screw, Cap, Hex Head, Brass, 1/4-20 Thd X 5/8" Lg	G	EA			
27	5305-00-984-6194 (21853G)	Screw, Pan Head, 8-32 X 5/8" Lg	H	EA			
28	5305-00-989-7434 (00337G)	Screw, Mach, Pan Head, Steel, 10-32 Thd X 1/2" Lg	N	HD			
29	5305-00-989-7435 (10292M)	Screw, Mach, Pan Head, Steel, 10-32 Thd X 5/8" Lg, MS35207-264	B,H	HD			
30	5305-00-995-3441 (10113D)	Screw, Mach, Slot Head, 10-32 X 1-1/2" Lg	H	EA			
31	5310-00-012-3190 (19637B)	Nut, Hex, Brass, 1/4-20 Thd Size	H	EA			
32	5310-00-045-3299 (09019J)	Washer, Lock, for No. 8 Screw, Split, Steel, Cad Pltd	H	HD			
33	5310-00-167-0833 (00487C)	Washer, Flat, for No. 8 Screw, Steel, Cad Pltd	H	HD			

DA FORM 1 APR 76 3071-R   EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

UNIT IDENT CODE:

DATE:

PAGE NO 4 | NO OF PAGES 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
34	5310-00-167-0834 (00488D)	Washer, Flat, Round, Steel, No. 10	N	HD			
35	5310-00-193-7486 (19655K)	Washer, Lock, Internal Teeth, Steel, 0.195" ID	B,C,N	HD			
36	5310-00-209-0790 (19193L)	Washer, Lock, External Teeth, Steel, 0.384" ID (Used for Bolting Racks Together; 4 per Interior Joint)	F,H	HD			
37	5310-00-262-3562 (10287B)	Washer, Lock, Split Helical Ring, Steel, 0.250" ID	G	HD			
38	5310-00-454-0542 (17597L)	Nut, Clip, Steel, 10-32 Thd, Emcor No. AHWX-092-003219 or Equal	G	EA			
39	5310-00-520-9178 (08726C)	Nut, Hex, Steel, 10-32 Thd, 0.312" Nom Across Flats, Finished, Camfered Bearing Surface	B,C	HD			
40	5310-00-550-2490 (07675L)	Nut, 8-32, Hex, Steel, Cad Pltd	H	EA			
41	5310-00-551-7739 (19628D)	Nut, Hex, Steel, 3/8-16 Thd, Washer-Faced Bearing Surface (Used for Bolting Racks Together; 4 per Interior Joint)	F,H	EA			
42	5310-00-595-6057 (19249K)	Washer, Flat, Round, Steel, 3/8" ID, 1" OD (Used for Bolting Racks Together; 4 per Interior Joint)	F,H	EA			
43	5310-00-934-9751 (07485Y)	Nut, Hex, Steel, 10-32 Thd, Cad Pltd	C,N	HD			
44	5310-00-942-5109 (19635Z)	Washer, Lock, External Teeth, Brass, 0.256" ID, 0.494" OD	G	HD			
45	5310-00-J01-3650 (19711J)	Nut, Keps, 10-32 Thd, W/Lockwasher, Emcor No. AHWX-102-003219 or Equal	E,P	EA			

DA FORM 1 APR 78 3071-R

EDITION OF 1 AUG 73 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS
For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035 | UNIT IDENT CODE:

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT | DATE: | PAGE NO. 5 | NO. OF PAGES 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
46	5325-00-J01-4017 (19761Y)	Support, Slide, Aluminum, 1/4" Thk X 23-9/16" Lg, 6-1/4" Wide (Used for Mounting Equipment Slides) (5340-00-X77-0386)	E	EA		
47	5340-00-456-2594 (24141M)	Slide, Equipment, 125-Lb Cap, Jonathan Part No. 110QDP-22-1 or Equal	K,L,J	PR		
48	5340-00-754-4560 (00740C)	Expansion Shield, 3/8-16 Thd Size, 0.563" Hole, Self-Drilling, 50 per Box	H	BX		
49	5365-00-J01-4018 (21343C)	Shim, Aluminum, 1/8" Thk, 1" W, 6-1/4" Lg (Used for Mounting Equipment Slides) (9535-00-X77-0387)	E	EA		
50	5365-00-J01-4019 (21344D)	Shim, Aluminum, 1/4" Thk, 1" W, 6-1/4" Lg (Used for Mounting Equipment Slides) (9535-00-X77-0388)	E	EA		
51	5510-00-134-3964 (16886A)	Lumber, 2" X 4" X 12'	H	BF		
52	5805-00-J01-3242 (21298B)	Panel, Closure, Plain, 19" W X 3-1/2" H X 5/8" O/A, 16-Gage Cold-Rolled Steel, Emcor No. PN-3 or Equal	F	EA		
53	5805-00-J01-3260 (21299C)	Panel, Closure, Plain, 19" W X 5-1/4" H X 5/8" O/A, 16-Gage Cold-Rolled Steel, Emcor No. PN-5 or Equal	F	EA		
54	5805-00-J01-6263 (21301E)	Panel, Closure, Plain, 19" W X 12-1/4" H X 5/8" O/A, 16-Gage Cold-Rolled Steel, Emcor No. PN-12 or Equal	F	EA		
55	5820-00-572-5533 (19664M)	Panel, Patch, 19" W X 3-1/2" H, Trompeter No. JSI-52 or Equal	F	EA		
56	5840-00-982-4465 (19547Z)	Retractor, Cable, Steel, 15" Lg Main Arm W/Spring-Loaded Mtg Bracket, 14" Lg Extension Arm Spring-Loaded on Other End, Jonathan No. CRS-25 or Equal	J,K,L,M	EA		

DA FORM 1 APR 78 3071-R — EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035

UNIT IDENT CODE:

TELEA NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

DATE:

PAGE NO: 6 | NO. OF PAGES: 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
57	5930-00-J01-4011 (19656J)	Switch Box, Elec, 2-1/2" Deep, 3" Lg, 2" W, Steel City, CD (5975-00-X76-3727)	C	EA		
58	5935-00-105-4641 (19679Z)	Plug, Twinax, BJ Type, Straight Bayonet Locking	F,H	EA		
59	5935-00-223-2821 (19687L)	Connector, Banana Type W/Ground, Pomona Electronics No. 1921	D	EA		
60	5935-00-283-4003 (10098Z)	Receptacle, Ac Pwr, Double Outlet, 2 Flat Prl Cont, 1 "U" Shape Gnd Ea Outlet, 15 A, 125 V	C	EA		
61	5935-00-411-5199 (19562P)	Jack, Twinax, Patch Type, Patch Jack Front End; Bayonet Latch Locking Back End Accepts Item 58 Above	F,H	EA		
62	5935-00-439-3748 (19689J)	Receptacle, Conn, 25-Pin, Fully Encl Cad Pltd Shell, 0.509" H, 2.103" Lg, 0.728" W, M24308-3-3	J	EA		
63	5935-00-509-2644 (08256N)	Power Strip, 12 Outlets, 0.75" H X 1.281" W X 6' Lg, Single 3-Wire Ckt, MFC 79725 Part No. 20GB606	N	EA		
64		ITEM DELETED				
65	5935-00-813-0620 (19654L)	Receptacle, Ac Pwr, Single Outlet, 2 Flat Prl Cont, 1 "U" Shape Gnd Cont, 15 A, 125 V	N	EA		
66	5935-00-832-5865 (18508F)	Plug, Ac Pwr, 2 Prl, 1 Gnd Cont, W/Cable Clamp, Cable Dia Range 0.296" to 0.625", 15 A, 125 V	A,Q	EA		
67		ITEM DELETED				

DA FORM 3071-R, 1 APR 73 — EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION				UNIT IDENT CODE			
SEIP 035							
TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT				DATE		PAGE NO. 7	NO. OF PAGES 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
68		ITEM DELETED					
69	5935-00-905-3949 (19691X)	Plug, Connector, 61-Pin, Fully Encl Aluminum Alloy Shell, Cad Pltd, W/Cable Clamp, Bayonet Latch Locking, MS3116F24-61PW	K,L	EA			
70	5935-00-916-5400 (19690J)	Plug, Connector, 10-Pin, Fully Encl Aluminum Alloy Shell, Cad Pltd, W/Cable Clamp, Bayonet Latch Locking, MS3116F12-10SW	J	EA			
71	5935-01-018-1713 (21545G)	Connector, Twinax, Bendix No. 33449-1 or Equal	D,M	EA			
72	5940-00-231-4430 (06255M)	Terminal Lug, 16/22 AWG Wire Size, Fork Opng for No. 6 Screw, Crimp Style, 25 per Pkg	H	PG			
73	5940-00-894-3405 (19658A)	Wire Joint, Ins Screw Cap, Accommodates 2 or More Cond of 10 Thru 18 AWG, 5 per Pkg	H,N	PG			
74	5970-00-177-1538 (06836E)	Tubing, Heat-Shrink, 0.197" ID, Recov to 0.093" ID, Black, FIT-105-3-16 or Equal	H	EA			
75	5970-00-419-4291 (11723H)	Tape, Ins, Vinyl Plastic, 3/4" W X 108' Lg	H	RO			
76	5970-00-727-6728 (12846W)	Tubing, Heat-Shrink, 3/8" Dia, Alpha Wire, FIT-221-3/8 or Equal	H,Q	FT			
77	5970-00-767-0511 (07131Q)	Tubing, Heat-Shrink, 0.750" ID, Recov to 0.375" ID, Clear, FIT-221-3/4 or Equal	H	FT			
78	5970-00-788-4901 (13561K)	Tape, Ins, Elec, Scotch No. 27, 3/4" X 66'	H	RO			

DA FORM 1 APR 78 3071-R EDITION OF 1 AUG 73 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

UNIT IDENT CODE:

DATE: | PAGE NO 9 | NO. OF PAGES 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
79	5970-00-903-8733 (08799J)	Tubing, Heat-Shrink, 3/32" Dia, Alpha Wire, FIT-221-3/32 or Equal	H	FT			
80	5970-00-939-8941 (05044N)	Tubing, Heat-Shrink, 0.375" ID, Recov to 0.187" ID, Black, FIT-105-3/8	H	FT			
81	5970-00-945-2848 (02310Z)	Tubing, Heat-Shrink, 1" ID, Recov to 0.5" ID, Black, FIT-105-1IN or Equal	H	FT			
82	5970-00-990-9912 (08798K)	Tubing, Heat-Shrink, 1/8" Dia, Alpha Wire, Clear, FIT-221-1/8 or Equal	H,Q	FT			
83	5970-00-J01-3972 (19556K)	Standoff, Phenolic, 1/4-20 Thd, Hex, 1/2" Dia, 1" Lg, MFCN 99813, No. SH81614-PH (5975-00-X76-3663)	G	EA			
84	5970-00-J01-4015 (19529D)	Tubing, Heat-Shrink, 0.375" Size, Cut to 2" Lgths, 4' per Pkg (5970-00-X76-6840)	H	PG			
85	5975-00-097-8511 (19729F)	Cover Plate, Duplex Elec Outlet, 4.5" Lg, 2.75" W, Stainless Steel Matl, 2 Openings	C	EA			
86	5975-00-188-1164 (02397J)	Cover, Junction Box, Duplex, Steel, 4" Lg, 2.125" W	C	EA			
87	5975-00-244-7806 (03056K)	Entrance End Ftg, F/U/W 7/8" X 1-1/4" Duct, 1.3438" H, 2.3125" Lg	N	EA			
88	5975-00-284-5827 (02515G)	Junction Box, Rect Handy Box, 4" Lg, 2.125" W, 2.125" Deep, Steel Matl	C	EA			
89	5975-00-284-6755 (19652N)	Duct, Base, Str, 7/8" X 1-1/4" X 10', Steel, Buff; Requires 2100C Cover	N	EA			
90	5975-00-378-5313 (21339Z)	Duct, Cover, Str, 7/8" X 1-1/4" X 5', Steel, Buff, F/U/W the Above Base (Item 89)	N	FT			

DA FORM 1 APR 78 3071-R — EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION		UNIT IDENT CODE		
SEIP 035				
TELER NUMBER		DATE	PAGE NO	NO OF PAGES
WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT			9	13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
91	5975-00-404-0026 (10308B)	Cable Tie, 0.184" W, 7.31" Lg, 0.0625" to 1.75" Bundle Dia Range	H	EA			
92	5975-00-673-7658 (13789F)	Entrance End Ftg, F/U/W 3/4" X 1-9/32" Duct, 1.5625" H X 2.375" Lg	N	EA			
93	5975-00-681-3729 (03032M)	Panel, Blank, 19" W, 15-3/4" H, Aluminum, 1/8" Thk, Gray Color	F	EA			
94	5975-00-682-0461 (19657Z)	Box Connector, Iron or Steel Matl, 0.688" Max Cable Opening, F/U/W Cable or Flexible Metal Conduit	C	EA			
95	5975-00-685-9538 (19548A)	Panel, Blank, 19" W, 3-1/2" H, Aluminum, 3/16" Thk, Gray Hammertone Color	F	EA			
96	5975-00-685-9539 (19751N)	Panel, Blank, 19" W, 7" H, Aluminum, 3/16" Thk, Gray Hammertone color	F	EA			
97	5975-00-685-9544 (22317W)	Panel, Closure, Plain, 19" W X 1-3/4" H X 5/8" O/A, 16-Gage, Cold-Rolled Steel, Emcor No. PN-1 or Equal	F	EA			
98	5975-00-727-5153 (07457J)	Cable Tie, 0.094" W, 3.62" Lg, 0.0625" to 0.625" Bundle Dia Range, Natural Color	H	HD			
99	5975-00-903-2284 (10309C)	Cable Tie, 0.094" W, 3.62" Lg, 0.0625" to 0.625" Bundle Dia Range, Black Color	H	HD			
100	5975-00-937-4501 (08711J)	Panel, Blank, 19" W, 5-1/4" H, Aluminum, 1/8" Thk, Gray Color	F	EA			
101	5975-00-937-4583 (00879Z)	Panel, Blank, 19" W, 1-3/4" H, Aluminum, 1/8" Thk, Gray Color	F	EA			
102	5975-00-985-6630 (03677K)	Cable Tie, 0.301" W, 13.38" Lg, 0.1875" to 3.5" Bundle Dia Range, Black Color	H	HD			

DA FORM 1 APR 72 3071-R   EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035 | UNIT IDENT CODE:

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT | DATE: | PAGE NO 10 | NO OF PAGES 13

ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
103	5975-00-J01-3697 (19631M)	Panel, Closure, Plain, 19" W X 19-1/4" H X 5/8" O/A, Plastic Laminated, Emcor No. PN-19F or Equal	F	EA			
104	5975-00-J01-3713 (19632L)	Vent Grille, 19" W X 7" H X 0.625" Thk, Clear Anodized Aluminum Matl, Emcor No. AVGX-XXX-00-719	P	EA			
105	5975-00-J01-3718 (19627C)	Mounting Angle, Panel Adj, 61" Lg, 11-Gage, Cold-Rolled Steel, 10-32 Tapped Holes One Leg and 9/32" Dia Holes Other Leg, Emcor No. PMA-61A-1032-1	F	EA			
106	5975-00-J01-3721 (21338W)	Mounting Angle, Panel Adj, 70" Lg, 11-Gage, Cold-Rolled Steel, 10-32 Tapped Holes One Leg and 9/32" Dia Holes Other Leg, Emcor No. PMA-70A-1032-1	F	EA			
107	5975-00-J01-3722 (19752M)	Panel, Blank, 19" W, 12-1/4" H, Aluminum, 3/16" Thk, Elec Blue Color, MFCN 74156, No. 6681-3	F	EA			
108	5975-00-J01-3944 (19705D)	Patch Cord, Twinax, 135-Ohm, 2' Lg, Dynatech Part No. 152-10-2	F	EA			
109	5975-00-J01-3946 (19707F)	Patch Cord, Twinax, 135-Ohm, 2' Lg, W/Test Points to Monitor Patched Circuits, Dynatech Part No. 152-11-2	F	EA			
110	5995-00-092-4489 (19676L)	Patch Cord, Twinax, 78-Ohm, 24" Lg, W/PL71-9 Patch Plug Both Ends, Trompeter No. PTW-24-78 or Equal	F	EA			
111	5995-00-J01-3700 (19675M)	Patch Cord, Twinax, 78-Ohm, 12" Lg, W/PL71-9 Patch Plug Both Ends, Trompeter No. PTW-12-78 or Equal	F	EA			
112	6145-00-112-8581 (03332J)	Wire, Jumper, Dist Frame, 4 Solid Cond, Tin Pltd, 22 AWG, PVC Ins, Black, White, Red, Green Cond Colors	H	FT			
113	6145-00-184-5346 (03507W)	Wire, Elec, 10 AWG, Solid Cond, White Thermoplastic Ins, 600 V Ac Max Working Voltage	N	FT			

DA FORM 1 APR 78 3071-R — EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS
For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035				UNIT IDENT CODE			
TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT				DATE		PAGE NO. 11	NO. OF PAGES 13
ITEM NO.	**STOCK NUMBER**	**NOMENCLATURE**	**MAJOR ASSEMBLY ITEM**	**UNIT**	**TOTAL REQ FOR PROJECT**	**AVAILABLE IN COMMAND**	**REQUIRED**
114	6145-00-184-5347 (03508Z)	Wire, Elec, 12 AWG, Solid Cond, White Thermoplastic Ins, 600 V Ac Max Working Voltage	C,N	FT			
115	6145-00-184-5349 (03510A)	Wire, Elec, 10 AWG, Solid Cond, Red Thermoplastic Ins, 600 V Ac Max Working Voltage	N	FT			
116	6145-00-184-5350 (03511B)	Wire, Elec, 12 AWG, Solid Cond, Red Thermoplastic Ins, 600 V Ac Max Working Voltage	C,N	FT			
117	6145-00-191-2569 (05285Y)	Wire, Elec, 10 AWG, Solid Cond, Green Thermoplastic Ins, 600 V Ac Max Working Voltage	H,N	FT			
118	6145-00-191-2570 (03534C)	Wire, Elec, 12 AWG, Solid Cond, Green Thermoplastic Ins, 600 V Ac Max Working Voltage, 500' per Coil	C,H,N	CL			
119	6145-00-191-2575 (03538G)	Wire, Elec, 10 AWG, Solid Cond, Black Thermoplastic Ins, 600 V Ac Max Working Voltage	N	FT			
120	6145-00-191-2576 (03539H)	Wire, Elec, 12 AWG, Solid Cond, Black Thermoplastic Ins, 600 V Ac Max Working Voltage	C,N	FT			
121	6145-00-284-1499 (03588B)	Wire, Jumper, Dist Frame, 2 Solid Cond, Tin Pltd, 22 AWG, PVC Ins, Black, White Cond Colors	H	FT			
122	6145-00-548-2423 (11518B)	Wire, Jumper, Elec, Single, Solid, Plastic Ins, 22 AWG Cond, White	H	SL			
123	6145-00-553-7823 (17250R)	Cable, 78-Ohm, RG-108 A/U, 20 AWG Stranded Inner Cond, Braided Copper Shld	D,J,K, L,M	FT			
124	6145-00-635-4603 (03616H)	Cable, 3-Cond, 12 AWG, Pwr, Thermoplastic Ins, Galvanized Steel Armor Covering, 600 V RMS Max Oper Voltage, Black/White/Red Cond Colors, 250' per Coil	N	CL			

DA FORM 1 APR 78 3071-R EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105-22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035

TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT

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DATE:

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ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
125	6145-00-721-4066 (20245E)	Cable, 124-Ohm, 22 AWG Stranded Inner Cond, Braided Copper Shld, Trompeter TWC-124-2	D,J	FT			
126	6145-00-823-2006 (24142L)	Cable, 3-Cond, 18 AWG, Pwr, Thermoplastic Ins, Black/White/Green, W/Thermoplastic Jacket, 600 V RMS Max Oper Voltage	A,Q	FT			
127	6145-00-866-2304 (15103Z)	Cable, 9-Pair, 22 AWG, Solid Cond, Ind Shld Pair W/Drain Wire, Belden No. 8764 or Equal	F,Q	FT			
128	6145-00-866-2305 (14546D)	Cable, 15-Pair, 22 AWG, Solid Cond, Ind Shld Pair W/Drain Wire, Belden No. 8766 or Equal	F,Q	FT			
129	6145-00-866-2306 (11502G)	Cable, 6-Pair, 22 AWG, Solid Cond, Ind Shld Pair W/Drain Wire, Belden No. 8768 or Equal	F,Q	FT			
130	6145-00-910-2005 (09013P)	Wire, 8 AWG, Solid, TW, Green	F,Q	FT			
131	6145-00-941-6469 (06917W)	Cable, 3-Cond, 10 AWG, Pwr, Thermoplastic W/Paper Serv Ins, Steel Armor Covering, Black/Red/White Cond Colors	C,N	FT			
132	6145-00-J01-3521 (21639C)	Cable, Twinaxial, 78-Ohm, Trompeter TWC-78-2	D,J,K, L,M	FT			
133	9530-00-277-8552 (06959G)	Bus Bar, Copper, 1/4" Thk, 1" W, 10' Lg	G	FT			
134	9905-00-368-5951 (19619F)	Identification Plates, F/U/W Ty-Rap Straps, 2" Lg, 3/4" W, 0.01" Thk, Nylon Matl, Supplied in Strips of 50, T&B TC-126-S or Equal	H	SP			
135	NSNR (22319A)	Panel, Closure, Plain, 19" W X 7" H X 5/8" O/A, 16-Gage, Cold-Rolled Steel, Emcor No. PN-7 or Equal	F	EA			

DA FORM 3071-R, 1 APR 78 — EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

TELECOMMUNICATIONS DEVELOPMENT PROJECT – BILL OF MATERIALS

For use of this form, see AR 105 22; the proponent agency is the United States Army Communications Command.

LOCATION: SEIP 035				UNIT IDENT CODE			
TELER NUMBER: WIDEBAND SECURE VOICE NETWORK EXTENSION PROJECT				DATE		PAGE NO. 13	NO OF PAGES 13
ITEM NO.	STOCK NUMBER	NOMENCLATURE	MAJOR ASSEMBLY ITEM	UNIT	TOTAL REQ FOR PROJECT	AVAILABLE IN COMMAND	REQUIRED
136	NSNR (21652D)	Wire, Elec, 6 AWG, TW, Stranded, Yellow	F,G	FT			
137	NSNR (21719F)	Terminal Lug, No. 8, Sta-Kon, T&B RD367	H	EA			

DA FORM 1 APR 78 3071-R EDITION OF 1 AUG 72 IS OBSOLETE.

Figure 5-1. Bill of Materials (Continued).

SECTION 6. QUALITY ASSURANCE PROCEDURES

6.1 GENERAL. The quality assurance (QA) criteria defined in CCR 702-1-2, chapter 5, will be applied to this project. The QA procedures in this section will be used to determine the acceptability of the installation and the functional performance as defined in sections 1 and 3.

6.2 INSPECTION RESPONSIBILITIES.

6.2.1 Installation Agency. The installation agency is responsible for quality control (QC) inspections in accordance with CCR 702-1-2, the Air Force T.O. 31-10 series, and this SEIP. QC inspections will be performed to ensure compliance with equipment, subsystems, and system level requirements. A QC representative (QCR) shall be identified, prior to start of installation, to serve as a point of contact for the QC effort. The QCR is responsible for the timely accomplishment of the following actions:

a. Completion of checklist, USACEEIA FM 112-R, figure 6-1, during QC inspections in accordance with CCR 702-1-2.

b. Preparation of QC reports, using approved installation agency forms.

c. Ensuring coordination and provision of test equipment required.

d. Performance of shakedown tests and maintenance of daily log of results, using approved installation agency forms.

e. Ensuring that a written statement of readiness is issued to the applicable USACEEIA-QA element 20 days prior to the estimated completion date of shakedown tests. The statement shall verify that the installation is ready for acceptance testing.

f. Coordination with the installation team leader for identifying one installer who will assist in the final QA inspection and acceptance test.

g. Ensuring that QC discrepancies are corrected and that installation rework is performed, if test results are not satisfactory.

h. Coordinating the availability of QC inspection records and related installation documents for the QA representative/test director, identified as the quality assurance representative (QAR).

6.2.2 Testing Agency. The testing agency is responsible for periodic in-process QA checks, final QA inspection, and acceptance testing in accordance with provisions of USACEEIA Regulation 702-3. QA inspections will be performed to monitor the QC effort and to ensure that the installation meets the required performance parameters at the equipment, subsystem, and system levels, as applicable. A QAR will be identified, prior to start of installation, to serve as a point of contact for the QA and test effort and to ensure that the following actions are taken in a timely manner:

a. Establish a QA program that monitors the QC and installation efforts to ensure compliance with stated requirements.

b. Record the information required by figure 6-2, pertaining to cognizant agency, command, and facility points of contact.

c. Review QC and installation records and perform periodic in-process QA inspections, if deemed necessary because of the size and complexity of the installation, and report discrepancies to the responsible agency. Recommendations for corrective action will be included in any discrepancy reports.

d. Perform a final QA inspection in accordance with CCR 702-1-2.

e. Conduct functional performance tests in accordance with section 7 to determine if the installed equipment, subsystem, or system meets the required performance parameters. If the results of any portion of the acceptance test are not satisfactory, corrective action will be taken immediately by on-site personnel, if possible. If discrepancies are resolved, the QAR may retest to verify the results and continue the acceptance test. If discrepancies cannot be corrected immediately, the QAR may reject the equipment, subsystem, or system or attempt to complete the test with exceptions. Exceptions will be noted in the final test and acceptance report.

f. Record and analyze test results, prepare a final test and acceptance report, and make distribution in accordance with CCCR 702-2.

6.2.3 Operating Agency. The operating agency is responsible for providing support during installation and test. An operations and maintenance (O&M) representative shall be identified, prior to start of installation, to serve as the point of contact for the project and to ensure that the following actions are taken in a timely manner:

a. Provide administrative supplies and typing support.

b. Assist in resolution of discrepancies.

c. Make operation and maintenance personnel available to assist on an as-required basis.

d. Provide a representative to witness the acceptance test and sign the Technical Acceptance Recommendation (TAR).

6.3 DOCUMENTATION.

6.3.1 Quality Control Documentation. The installation QC will be documented using a QC checklist similar to figure 6-1 and the approved installation agency report forms. A QC inspection log will be maintained on a daily basis during inspection periods. The daily log may be in any format unless installation agency policy dictates otherwise.

6.3.2 Quality Assurance Documentation. QA inspections will be documented using a QA checklist similar to figure 6-1; the sample cognizant agency, command, and facility points of contact form, figure 6-2; and the QA checklist, figure 6-3. The final QA inspection shall be documented utilizing the TAR forms shown in section 8. The Test and Acceptance Report shall be in accordance with CCCR 702-2. A QA inspection log will be maintained on a daily basis during inspection periods. The daily log may be in any format unless testing agency policy dictates otherwise.

6.4 QUALITY ASSURANCE PLAN. The inspection responsibilities assigned in this section constitute the QA plan and establish an independent evaluation loop. The evaluation loop consists of the installation agency QC effort and the testing agency QA and test effort. Acceptance of the installation by the O&M command is contingent upon the successful demonstration, during acceptance testing, that the installed equipment meets required performance parameters. A coordinated effort during the installation effort between the installation, testing, and operating agency personnel is required to assure that the highest standards of quality are maintained in accordance with QA procedures.

6.4.1 QA inspections and tests may be interrupted at any point if disrupted by a hardware malfunction. They also may be interrupted at a compatible breaking point to permit scheduled duty breaks. Any inspection that is interrupted because of a hardware malfunction shall be restarted at a point determined by the QAR.

6.4.2 Spare equipment may be substituted for malfunctioning equipment with the approval of the QAR. Any equipment that has been replaced shall be repaired and reinspected.

6.4.3 During acceptance tests, any piece of equipment (including items such as cables and conduits) may not be changed or adjusted without the approval of the QAR.

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)			PAGE 1 OF 11 PAGES DATE (Day, Mo, Year)
SITE	LOCATION		
PROJECT NAME			TASK NO.
REFERENCED T.O. FOR QUALITY OBSERVATIONS FOLLOW MAIN PARAGRAPHS	YES	NO	NA
A. <u>Drawings and Specifications</u> (AFTO 31-10-3, 31-10-9, 31-10-27, 31-10-29)			
1. Are floor plan drawings available?			
2. Are equipment location drawings available?			
3. Are face layout drawings of equipment in bays available?			
4. Are drawings for distribution frame block assignments available?			
5. Are pin connections on terminal blocks shown on drawings?			
6. Is stenciling of terminal blocks shown on drawings?			
7. Are drawings of power distribution equipment available?			
8. Are wire sizes indicated on drawings?			
9. Are schematic diagrams of circuit types to be installed included in drawings?			
10. Are drawings of site grounding systems available?			
11. Are drawings showing arrangement of cable racks, ducts, and trenches available?			
12. Do specifications contain list of reference material required by installers?			
13. Do specifications contain cable running list for power distribution?			
14. Do specifications contain cable running list for signal cabling?			

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Figure 6-1. QA Inspection Checklist - Installation.

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)			PAGE 2 OF 11 PAGES
	YES	NO	NA
15. Do specifications contain cable running list for RF cabling?			
16. Do specifications contain detailed information on grounding?			
17. Do specifications contain details on all special instructions for installers?			
18. Do drawings reference all applicable items on BOM?			
B. Tools and Equipment (AFTO 31-10-29)			
1. Is equipment damaged or unserviceable?			
2. Are all installation materials on hand and serviceable?			
3. Are all tools necessary for completion of the job on hand?			
4. Is all test equipment needed for test and checkout of installation available?			
C. General Safety Practice (AFTO 31-10-29)			
1. Are goggles being worn when drilling and grinding?			
2. Are sharp edges left on frame or duct work?			
3. Are all hand tools properly used?			
4. Are electric power tools properly grounded?			
D. Floor Plan Layout (AFTO 31-10-9, 31-10-29)			
1. Are equipment layout plans in accordance with drawings?			
2. Was layout plan completed before equipment was moved into area?			
E. Erecting and Mounting (AFTO 31-10-29)			
1. Is equipment laid out in accordance with floor plan drawing?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 3 OF 11 PAGES		
	YES	NO	NA
2. Are equipment bays level and plumbed within tolerances?			
3. Has proper spacing been provided between equipment racks?			
4. Are base angles of frames secured to floor in proper location?			
5. Are all cabinets flush mounted and plumbed?			
6. Has finish of equipment, cabinets, and racks been touched up?			
7. Are bolts and screws free from stripped threads and defaced heads?			
8. Have sufficient clearances been provided between apparatus for heat dissipation?			
9. Are terminal blocks aligned on distribution frames?			
10. Has equipment been installed in cabinets or racks in accordance with face layouts?			
11. Are all nuts and bolts securely tightened?			
12. Are exposed or cut ends of metal filed smooth and painted?			
13. Have lock and flat washers been used?			
14. Is the C-E equipment BOM available at the facility?			
15. Has the C-E equipment been inventoried and discrepancies posted?			
16. Is all required C-E equipment at the site?			
17. Is all C-E equipment installed?			
F. Cable Racks (AFTO 31-10-6)			
1. Location of cable racks:			
a. Are cable racks located in accordance with cable plan drawing?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 4 OF 11 PAGES		
	YES	NO	NA
b. Does height of cable racks conform to height above floor as indicated on cable plan drawing?			
c. Are cable racks located so that clearance is provided for installation and maintenance of ultimate equipment?			
d. Are cable racks located so cables are not subject to damage or exposure or other detrimental conditions?			
2. Assembly of cable racks:			
a. Are long sections of cable racks used where possible?			
b. Have clamping details been altered other than where necessary to avoid interference?			
c. Are open ends of cable racks properly closed?			
d. Are vertical cable racks properly terminated on floors?			
3. Support of cable racks:			
a. Are cable racks properly supported and fastened?			
b. Are cable racks installed so that no excessive load or binding is imposed on the equipment?			
c. Are horizontal cable racks supported on approximately 5 feet centers but not to exceed 6 feet?			
d. Has support been provided within 3 feet of free end of cable rack?			
e. Are cable racks braced where necessary to prevent sway?			
G. Running Cable (AFTO 31-10-13)			
1. Are cable runs made in accordance with cable running list?			
2. Are cables twisted or crossed on cable rack?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 5 OF 11 PAGES		
	YES	NO	NA
3. Do cables at turns or bends conform to the bending radii and position?			
4. Is protection provided where cable sheaths contact rough or sharp edges or metal?			
5. Are cables which are turned off over side of cable racks formed with minimum allowable radii?			
6. Are cables turned off rack horizontally and then up?			
7. Do cables to the distribution frame enter on the vertical side?			
8. Are cables serving the horizontal side of a distribution frame secured to the transverse arms near the vertical upright?			
9. Are cable tags properly prepared and in accordance with the cable running list?			
10. Are cable tags secured at each end of cable run?			
11. Have cable tags been removed upon completion of verification and termination?			
12. Are cable butts located as near as practicable to the point where the first wires turn out?			
13. Are cable butts properly treated?			
14. Is insulation of wires undamaged at butt location?			
15. Are unused and spare wires protected at butt location?			
H. Securing Cable (AFTO 31-10-2, 31-10-13)			
1. Is starting stitch properly made and placed?			
2. Is required Kansas City stitch properly made?			
3. Are first and succeeding layers of cable properly secured?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 6 OF 11 PAGES		
	YES	NO	NA
4. Are cables secured at every cable rack cross strap?			
5. When cable butt is between securing devices, are cables secured together with an appropriate stitch?			
6. Are lock stitches properly made and spaced?			
7. Are splices in twine properly made?			
I. Sewed Forms (AFTO 31-10-13)			
1. Is proper size twine used for the diameter of the form?			
2. Are proper number of strands used?			
3. Are stitches properly spaced?			
J. Butting and Stripping (AFTO 31-10-13)			
1. Are proper tools used for butting and stripping of cable?			
2. Are cable butts properly dressed?			
3. Is proper distance maintained from cable butt to fanning strip?			
K. Fanned Forms (AFTO 31-10-2)			
1. Are cables fanned and connected to the left side of vertical mounted terminal blocks and to the bottom of horizontal terminal blocks?			
2. Are conductors in fanned forms twisted and bunched?			
3. Are fanned forms straight and taut from butt location to fanning strip?			
4. Is length of skinners correct?			
5. Has color code been properly followed?			
6. Are spare wires disposed of properly?			
L. Stenciling (AFTO 31-10-27, 31-10-29)			
1. Is equipment correctly identified and stenciled in accordance with floor plan drawings?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 7 OF 11 PAGES		
	YES	NO	NA
2. Are designations located correctly?			
3. Are correct size designations used on particular types of apparatus or equipment?			
M. <u>Strapping</u> (AFTO 31-10-16)			
1. Are straps properly placed?			
2. Is correct type of strap wire used?			
3. Does insulation extend to terminal?			
4. Are straps placed so as not to interfere with operation of apparatus?			
5. Is removal of apparatus blocked?			
6. Are designations of apparatus obscured?			
N. <u>Connecting and Soldering</u> (AFTO 31-10-7)			
1. Is soldering clamp used when connecting wires?			
2. Are connections made on terminal blocks in proper manner?			
3. Is all soldering done with standard rosin core solder?			
4. Are connections secure and free of foreign substances?			
5. Has all unsightly flux and excess globules of solder been removed?			
6. Is insulation on skinners burnt or otherwise damaged?			
7. Do skinners on connected terminals exceed 1/16 in?			
8. Are all conductors given a continuity test after connection is made?			
O. <u>Wrapped Connections</u> (AFTO 31-10-7)			
1. Are wrapped connections applied only on suitable terminals?			
2. Are connections essentially straight and free of angular bends or crimps?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 8 OF 11 PAGES		
	YES	NO	NA
3. Are the required number of turns in contact with the terminal in accordance with criteria for gauge of wire used?			
4. Are wrapped connectors soldered where applicable?			
P. Cross Connections (AFTO 31-10-11)			
1. Are jumpers properly routed at distribution frame?			
2. Do jumpers have sufficient slack after connection?			
3. Are conductors twisted between fanning strip and terminal?			
4. Does twist remain in conductors beyond rear of fanning strip?			
5. Are jumpers properly dressed?			
6. Has excess solder been removed from terminals?			
Q. Equipment and Signal Grounds (AFTO 31-10-24, 31-10-29)			
Are equipment and signal grounds installed in accordance with applicable codes and standards and in accordance with installation drawings?			
R. Conduit (AFTO 31-10-12)			
1. Are burrs removed from conduit after cutting?			
2. Is bending radii of conduit adequate?			
3. Are there more than four 90-degree bends in a single conduit run?			
4. Does number of conductors in conduit conform?			
5. Are conduits supported at intervals not exceeding 6 feet?			
6. Have all fittings been tightened after installation?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 9 OF 11 PAGES		
	YES	NO	NA
S. Ducts (RF Shieldings) (AFTO 31-10-12, 31-10-13)			
1. Are hangers for overhead ducts mounted first?			
2. Is proper type mallet used in assembly?			
3. Are flange sections cleaned before installation?			
T. Coaxial Cables (AFTO 31-10-14)			
1. Is cable inspected for possible damage prior to installation?			
2. Where required, is cable sewed in same manner as signal cable?			
3. Is butting and stripping done in same manner as signal cable?			
4. Do cable tags remain on coaxial cable from antenna to RF patch or equipment?			
5. Is support spacing of cables installed as prescribed (3 ft for cable 1-5/8 in or smaller and 5 ft for cables 1-11/16 in or greater)?			
6. Does bending radii of cables meet prescribed standards of the T.O.?			
U. Waveguides and Antennas (AFTO 31R-10-5, CEEIA PAM 105-3)			
1. Are waveguides stored in a horizontal manner and away from heavy objects?			
2. Are waveguides inspected for possible damage prior to installation?			
3. Are waveguides cleaned in the proper manner prior to installation?			
4. Are hangers installed every 5 feet as prescribed?			
5. Do waveguide bends conform to T.O. criteria?			
6. Are antennas and reflectors mounted as prescribed heights?			
7. Are antennas oriented to the prescribed azimuth?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 10 OF 11 PAGES		
	YES	NO	NA
V. Outside Plant Inspection (AFTO 31R-10-5, 31-10-5, 31-10-3, 31-10-10, 31-10-21, 31-10-24, 31-10-28)			
1. Are antenna tower locations proper?			
2. Are footings or pads prepared prior to concrete pour?			
3. Have concrete pours for footings and pads been accomplished in accordance with specified criteria?			
4. Has proper cure time been achieved prior to mounting steel?			
5. Is the tower constructed in accordance with the specified criteria, drawings, etc?			
6. Are the antenna supports, anchors, pedestals, etc., properly installed in accordance with established criteria?			
7. Are supporting structures, guy wires, tower lighting kits (when required), termination boxes, and baluns included and properly installed in accordance with established criteria?			
8. Are antennas properly mounted and aligned?			
9. Were antenna reflectors properly aligned prior to mounting the feed horn?			
10. Are antenna curtains for rhombic and log periodics properly installed?			
11. Are transmission lines, coaxial cables, waveguides, etc., properly installed?			
12. Has tower and supporting structure been painted in accordance with established criteria?			
13. Are waveguides, cable runs, etc., properly installed and protected?			
W. Power Buildings (AFTO 31-10-3, 31-10-29)			
1. Are power buildings and pads properly located and installed?			

Figure 6-1. QA Inspection Checklist - Installation (Continued).

QUALITY ASSURANCE INSPECTION CHECKLIST - INSTALLATION (CCCR 702-2)	PAGE 11 OF 11 PAGES		
	YES	NO	NA
2. Are generators and power distribution panels properly located and installed?			
3. Are oil pans properly installed?			
4. Are generators properly vented from the buildings?			
5. Has all required wiring been installed?			
6. Are fuel tanks installed above ground; if so, are they located at the proper distance from generator building?			
7. If fuel tanks were installed underground, was it accomplished in accordance with established procedures?			
8. Is safety equipment located in generator building?			
X. Installation Drawings (AFTO 31-10-29)			
Have drawings been reviewed to assure "as built" accuracy?			

TEST ENGINEER/QUALITY ASSURANCE REPRESENTATIVE (QAR)

Figure 6-1. QA Inspection Checklist - Installation (Continued).

COGNIZANT AGENCY, COMMAND, AND
FACILITY QA POINTS OF CONTACT
(CCCR 702-2)

	Individual POC	Bldg. No.	Rm. No.	Phone No.	Name of Agency
Installation:					
Team Leader					
Assistant Team Leader					
Quality Control					
Quality Assurance Agency:					
Representative					
Testing Activity					
Operating Agency:					
Representative					
Site Commander					

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Figure 6-2. QA Points of Contact.

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR 702-2)		PAGE 1 OF 7 PAGES DATE (Day, Mo, Year)
SITE	LOCATION	QUALITY CONTROL REPRESENTATIVE (QCR)
PROJECT NAME		TASK NO.

	YES	NO	NA
A. General Safety Practice			
1. Are goggles being worn when using grinding machines?			
2. Are sharp edges left on frame or duct work?			
3. Are all hand tools properly used?			
4. Are electric power tools properly grounded?			
5. Are ground wires securely attached?			
B. Floor Plan Layout			
1. Are layout plans in accordance with drawings?			
2. Was layout plan completed before equipment was moved into area?			
C. *Erecting and Mounting*			
1. Is equipment laid out in accordance with floor plan drawing?			
2. Are equipment bays leveled and plumbed within tolerances?			
3. Has proper spacing been provided between equipment racks?			
4. Are base angles of frames secured to floor in proper location?			
5. Are all cabinets flush mounted and plumbed?			
6. Has finish of equipment, cabinets, and racks been touched up?			
7. Are bolts and screws free from stripped threads and defaced heads?			

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Figure 6-3. QC Checklist - Installation.

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 2 OF 7 PAGES		
	YES	NO	NA
8. Have sufficient clearances been provided between apparatus for heat dissipation?			
9. Are terminal blocks aligned on distributing frames?			
10. Has equipment been installed in cabinets or racks in accordance with face layouts?			
11. Are all nuts and bolts securely tightened?			
12. Are exposed or cut ends of metal filed smooth and painted?			
D. Cable Racks			
1. Location of cable racks:			
a. Are cable racks located in accordance with cable plan drawing?			
b. Does height of cable racks conform to height above floor as indicated on cable plan drawing?			
c. Are cable racks located so that clearance is provided for installation and maintenance of ultimate equipment?			
d. Are cables located so they are not subject to damage due to exposure or other detrimental conditions?			
2. Assembly of cable racks:			
a. Are long sections of cable racks used where possible?			
b. Have clamping details been altered other than where necessary to avoid interference?			
c. Are open ends of cable racks properly closed?			
d. Are vertical cable racks properly terminated on floors?			
3. Support of cable racks:			
a. Are cable racks properly supported and fastened?			
b. Are cable racks installed so that no excessive load or binding is imposed on the equipment?			

Figure 6-3. QC Checklist - Installation (Continued).

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 3 OF 7 PAGES		
	YES	NO	NA
c. Are horizontal cable racks supported on approximately 5 feet centers but not to exceed 6 feet?			
d. Has support been provided within 3 feet or free end of cable rack?			
e. Are cable racks braced where necessary to prevent sway?			
E. Running Cable			
1. Are cable runs made in accordance with cable running list?			
2. Are oval shaped switchboard cables placed on edge?			
3. Are cables twisted or crossed on cable rack?			
4. Do cables conform to the bending radii and position at turns or bends?			
5. Is protection provided where cable sheaths contact rough or sharp edges or metal?			
6. Are cables turned off over side of cable racks formed with minimum allowable radii?			
7. Are cables turned off rack horizontally and then up?			
8. Do cables to the distributing frame enter on the vertical side?			
9. Are cables serving the horizonal side of a distributing frame secured to the transverse arms near the vertical upright?			
10. Are cable tags properly prepared and in accordance with the cable running list?			
11. Are cable tags secured at each end of cable run?			
12. Have cable tags been removed upon completion of verification and termination?			
13. Are cable butts located as near as practicable to the point where the first wires turn out?			
14. Are cable butts properly treated?			

Figure 6-3. QC Checklist - Installation (Continued).

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 4 OF 7 PAGES		
	YES	NO	NA
15. Is insulation of wires undamaged at butt location?			
16. Are unused and spare wires protected at butt location?			
F. Securing Cable			
1. Is starting stitch properly made and placed?			
2. Is required Kansas City stitch properly made?			
3. Are first and succeeding layers of cable properly secured?			
4. Are cables secured at every cable rack cross strap?			
5. When cable butt is between securing devices, are cables secured together with an appropriate stitch?			
6. Are lock stitches properly made and spaced?			
7. Are splices in twine properly made?			
G. Sewed Forms			
1. Is proper size twine used for the diameter of the form?			
2. Are proper number of strands used?			
3. Are stitches properly spaced?			
H. Butting and Stripping			
1. Are proper tools used for butting and stripping of cable?			
2. Are cable butts properly dressed?			
3. Is proper distance maintained from cable butt to fanning strip?			
I. Fanned Forms			
1. Are cables fanned and connected to the left side of vertical mounted terminal blocks and to the bottom of horizontal terminal blocks?			
2. Are conductors in fanned forms not twisted and bunched?			

Figure 6-3. QC Checklist - Installation (Continued).

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 5 OF 7 PAGES		
	YES	NO	NA
3. Are fanned forms straight and taut from butt location to fanning strip?			
4. Is length of skinners correct?			
5. Has color code been properly followed?			
6. Are spare wires disposed of properly?			
J. Stenciling			
1. Is equipment correctly identified and stenciled in accordance with floor plan drawings?			
2. Are designations correctly located?			
3. Are corrected size designations used on particular types of apparatus or equipment?			
K. Strapping			
1. Are straps properly placed?			
2. Is correct type of strap wire used?			
3. Does insulation extend to terminal?			
4. Are straps placed so as to not interfere with operation of apparatus?			
5. Is removal of apparatus not blocked?			
6. Are designations not obscured?			
L. Connecting and Soldering			
1. Is soldering clamp used when connecting wires?			
2. Are connections made on terminal in proper manner?			
3. Is all soldering done with standard resin core solder?			
4. Are connections secure and free of foreign substances?			
5. Have all unsightly flux and excess globules of solder been removed?			
6. Is insulation on skinners not burnt or otherwise damaged?			

Figure 6-3. QC Checklist - Installation (Continued).

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 6 OF 7 PAGES		
	YES	NO	NA
7. Do skinners on connected terminals not exceed 1/16 in?			
8. Are all conductors given a continuity test after connection is made?			
M. Transistor Soldering Techniques			
1. Is caution exercised to assure that excessive heat does not destroy transistors?			
2. Are safeguards in effect to prevent leakage current at the end of an electrical soldering iron from destroying transistors?			
N. Wrapped Connections			
1. Are wrapped connections applied only on suitable terminals?			
2. Are connections essentially straight and free of angular bends or cramps?			
3. Are the required number of turns in contact with the terminal in accordance with criteria for gauge of wire used?			
4. Are wrapped connectors soldered where applicable?			
O. Cross Connections			
1. Are jumpers properly routed at distribution frame?			
2. Do jumpers have sufficient slack after connection?			
3. Are conductors not twisted between fanning strip and terminal?			
4. Does twist remain in conductors beyond rear of fanning strip?			
5. Are jumpers properly dressed?			
6. Has excess solder been removed from terminals?			

Figure 6-3. QC Checklist - Installation (Continued).

QUALITY CONTROL CHECKLIST - INSTALLATION (CCCR-702-2)	PAGE 7 OF 7 PAGES		
	YES	NO	NA
P. Equipment and Signal Grounds			
Are equipment and signal ground installed in accordance with applicable codes and standards and in accordance with installation drawings?			
Q. Conduit			
1. Are burrs removed from conduit after cutting?			
2. Is bending radii in accordance with AFTO 31-10-12?			
3. Are there no more than four 90 degree bends in a single conduit run?			
4. Does number of conductors in conduit conform to AFTO 31-10-12?			
5. Are conduits supported at proper intervals?			
6. Have all fittings been tightened after installation?			
R. Ducts (RF Shieldings)			
1. Are hangers for overhead ducts mounted first?			
2. Is proper type mallet used in assembly?			
3. Are flange sections cleaned before installation?			
S. Coaxial Cables			
Is cable inspected for possible damage prior to installation?			

Figure 6-3. QC Checklist - Installation (Continued).

SECTION 7. TEST AND ACCEPTANCE

7.1 SCOPE. This section contains test procedures for use during the on-site test and acceptance of wideband secure voice network extension projects. Testing of equipment, subsystems, terrestrial transmission, and links is performed to assure that the equipment operates in accordance with the performance specified in this SEIP and supporting technical literature. Any deviation from this SEIP will require that the test procedures be analyzed for compatibility and validity. Any deviation in test procedures prepared by USACEEIA subcommands, field activities, or Government contractors must be approved by the Commander, USACEEIA, or his designated representative prior to implementation.

7.2 TEST CRITERIA. The criteria for acceptance or rejection are based on requirements stated in sections 1 and 3 and appendix F of this SEIP, associated drawings, and technical documentation. If any of the test results fail to meet the desired performance parameters, corrective action shall be taken by the responsible on-site engineering and installation personnel. Faulty equipment, cabling, or other installed BOM items shall be reworked. If rework is necessary, a decision shall be made by the test director to determine which portions, if any, of the previous tests were affected and those portions to be retested.

7.3 TEST EQUIPMENT. A composite list of all test, measurement, and diagnostic equipment (TMDE) employed in this section is provided in appendix E. This list also contains an item code number for each particular test unit. In developing test plans, personnel should use the code numbers to identify like equipments that have different performance parameters. Military nomenclature for the test equipment is provided in parentheses in the "Recommended model or equivalent" column of the listing. Each procedure given in the following paragraphs has a list of test equipment to be used in that particular test.

7.3.1 Equipment and Subsystem Checkout. Tools and test equipment required for checkout/alignment of equipment and subsystems will be identified and provided by the installation agency unless a written agreement is made with the operating agency to use on-site test equipment.

7.3.2 Terrestrial Transmission and Link Testing. TMDE required for terrestrial transmission and link acceptance testing will be provided by the testing agency at sites designated by the individual link test plans. The individual link test plans are provided in the individual EIPs. TMDE required at the designated operating agency sites includes:

a. Bit error rate (BER) test set.

b. DBm meter.

c. Audio oscillator.

7.3.3 Voltmeter Correction Factors. When a voltmeter is calibrated for 600-ohm impedances, the dB values listed must be added to the reading if lower impedances are measured. If a voltmeter is calibrated at one of the lower impedances and a higher impedance is measured, the difference factor between them must be subtracted for a true value. The correction factors for a 600-ohm voltmeter such as the HP-3400A rms voltmeter are as follows:

Impedance, ohms	Voltage across impedance, volts	Correction factor, dB*
600	0.7746	0
300	0.5477	3.0
150	0.3873	6.0
135	0.3674	6.5
75	0.2739	9.0
50	0.2236	10.8

*To be added to voltmeter reading.

7.4 TEST CONDITIONS. Tests outlined in this section shall be scheduled and controlled by the test director or his representative during the actual conduct of the tests. The following guidelines shall apply:

7.4.1 Start of Test. All equipment to be tested shall be in the normal operating condition, unless otherwise specified by the test procedures, at the beginning of each test.

7.4.2 Operator Actions. The current operator's manual shall be used to govern all operator actions performed during the test.

7.4.3 Sequential Steps. Test steps shall be performed sequentially. The results of each test step shall be verified as correct prior to performing the next step.

7.4.4 Environment. All testing shall be conducted in a normal operating environment (that is, 28 to 32 inches of mercury, 15 to 32° C, and a maximum relative humidity of 80 percent). Abnormal ambient conditions (for example, temperature, humidity, or barometric pressure) that occur during any test shall be noted in the test log, with detailed remarks included with the test results.

7.4.5 Test Conduct. All tests shall be conducted in accordance with paragraph 7.6 of this SEIP.

7.5 TEST RESULTS. The test director or his designated representative shall maintain a test log throughout the test. This log shall contain a chronological record of test conduct, problems, and other significant events and shall be used as a basis for preparing the final acceptance test report. For Army installations tested by USACEEIA subcommands, a copy will be forwarded within 30 days after completion of testing, as follows:

US Army Communications-Electronics
Engineering Installation Agency
ATTN: CCC-TED
Fort Huachuca, AZ 85613

7.6 TEST PLAN ORGANIZATION.

7.6.1 Equipment and subsystem checkout tests shall be performed by the installation agency. These tests shall be conducted and recorded in accordance with section 6 of this SEIP and normal installation agency policies and procedures using the test data sheets provided in appendix D. Appendix D identifies the applicable paragraph and test data sheet for each test. When necessary, forms other than those designated in appendix D may be used for recording data.

7.6.2 The equipment and subsystem checkout tests must be completed prior to the start of acceptance testing. Maximum effort will be made to ensure that the installation is operational before starting the acceptance testing.

7.7 PERFORMANCE TESTING OF DIGITAL DATA MODEM, INTERCONNECT FACILITY (MD-920/G).

7.7.1 Purpose. The purpose of these tests is to measure the performance of MD-920/G ICF modems associated with the transmission and reception of automatic wideband secure voice communications.

7.7.2 Tests To Be Performed. The tests to be performed are as follows:

a. Line-of-sight (LOS) baseband interface.

(1) Impedance.

(2) Output voltage level and stability.

b. Radio frequency (RF) cable interface.

(1) Impedance.

(2) Power output.

c. Bit error rate and alpha flunk versus E_b/N_o (where E_b = average energy per bit and N_o = noise power spectral density).

7.7.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Pattern generator/ error detector	HP-3780A	1	018
Error rate counter	Harris 7002	1	017
Oscilloscope	Tektronix 7603	1	029
Test oscillator	HP-654A	1	027
True rms voltmeter (VM)	HP-3400A	2	022
Modem test set	TS-3580/G	1	043
50-ohm termination, ±1.0%		1	001
75-ohm termination, ±1.0%		1	038
Characterized modem	MD-921/G or MD-1002/G	1	
Cable adapters (188C)			

7.7.4 Impedance (Z) Measurement Procedure.

a. Check the ICF modem for normal operation and alarm circuitry activation in accordance with chapter 3 of TM 11-5820-804-12. If all requirements are met, proceed as follows:

(1) Turn on all test equipment and allow for a 15-minute warmup and stabilization period.

(2) Configure the test equipment as shown in figure 7-1 following.

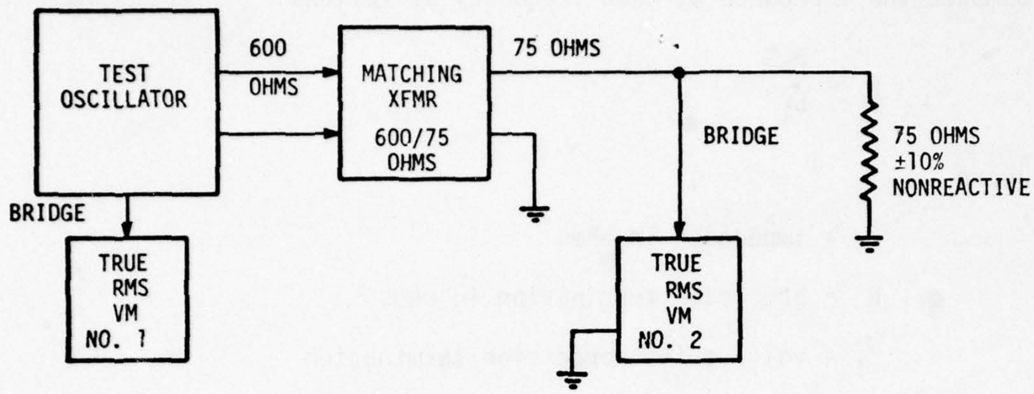


Figure 7-1. Nonreactive Load Configuration.

(3) Tune the test oscillator for an output power level of -10 dBm at a frequency of 25 kHz.

(4) Measure the voltage and dBm reading on true rms voltmeter No. 2. Record the indications.

(5) Disconnect the 75-ohm precision termination and connect the test equipment to the LOS output of the ICF modem (see figure 7-2 below).

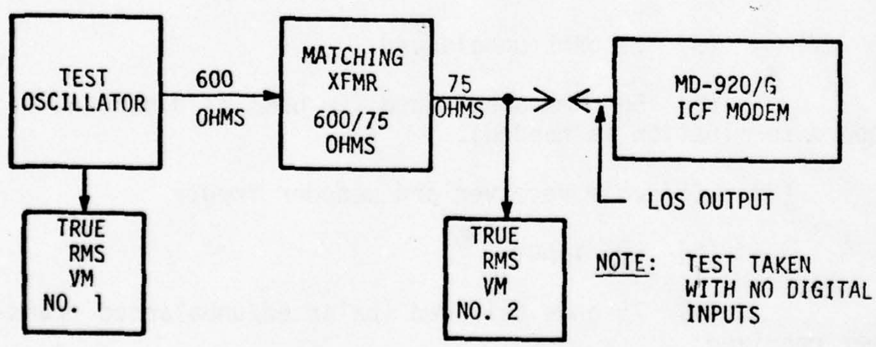


Figure 7-2. Impedance Test Configuration.

(6) Record the indication on voltmeter No. 2 and compare this reading and the reading taken in step (4) above. Compute the impedance at each frequency as follows:

$$Z = \frac{E_2 R}{E_1}$$

where

Z = impedance in ohms

R = precision termination in ohms

E_1 = voltage into precision termination

E_2 = voltage into load.

The impedance should be within ± 10 percent of the rated value.

b. Repeat this test at the following test points using test tone frequencies of 50 and 25 kHz.

(1) LOS/cable driver output:

(a) LOS output.

(b) 75 ohms balanced (balanced/unbalanced transformer required).

(c) 75 ohms unbalanced.

(d) 50 ohms unbalanced (50 ohms ± 1.0 percent standard termination is needed).

(2) LOS/cable receiver and decoder input:

(a) LOS input.

(b) 75 ohms balanced (balanced/unbalanced transformer required).

(c) 75 ohms unbalanced.

(d) 50 ohms unbalanced (50 ohms ± 1.0 percent standard termination is needed).

7.7.5 Output Voltage Level and Stability Check Procedure.

a. Configure the test equipment as shown in figure 7-3 following and adjust the ICF modem for internally coded output. Configure the HP-3780A to provide a transmit block size of 10^8 and push the start button.

b. Calibrate the oscilloscope to read 0.5 volt per centimeter and a 1-cycle display.

c. Measure and record the peak-to-peak (p-p) voltage as seen on the oscilloscope at each of the output test points listed in 7.7.4b above.

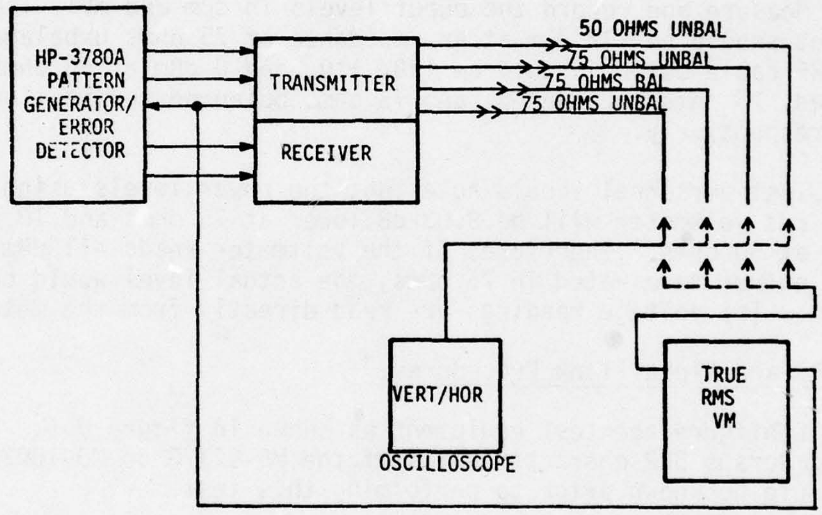


Figure 7-3. Level/Stability Test Configuration.

d. Note and record the values of the p-p variations in amplitude and phase (see figure 7-4 below). Precautions should be taken--such as measuring variations using another signal source--to ensure that the oscilloscope does not obscure the reading.

e. Disconnect the oscilloscope and connect the true rms voltmeter using the balanced/unbalanced transformer, as appropriate.

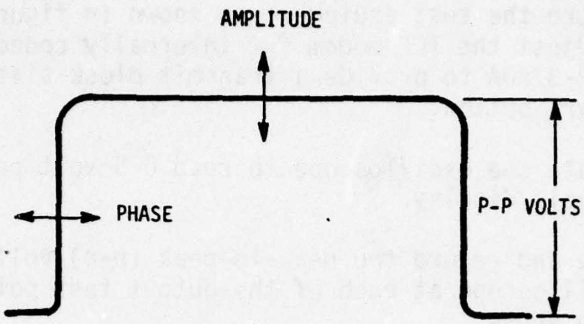


Figure 7-4. Oscilloscope Test Pattern.

f. Measure and record the ouput levels in dBm and mV. The LOS output should be -12 dBm at an impedance of 75 ohms unbalanced and the RF cable output should be +23, +10, and 0 dBm at 50 ohms unbalanced, 75 ohms unbalanced, and 75 ohms balanced termination points, respectively.

g. Test personnel should note that the power levels using the true rms voltmeter will be 9.03 dB lower at 75 ohms and 10.8 dB lower at 50 ohms. Therefore, if the voltmeter reads -11 dBm with the output terminated in 75 ohms, the actual level would be -1.97 dBm. The voltage readings are read directly from the meter.

7.7.6 BER and Alpha Flunk Procedures.*

a. Configure the test equipment as shown in figure 7-5. The E_b/N_o versus BER characteristics of the MD-921/G or MD-1002/G modem should be known prior to performing this test.

b. After characterizing the PSK modem, denote the E_b/N_o required to provide a BER of less than one error in 10^{-6} and adjust the TS-3580/G to that denoted E_b/N_o and a noise bandwidth of 46.989 dB, as applicable, to a data rate of 50 kb/s.

*General information and procedure for alpha flunk measurements are given in appendix C.

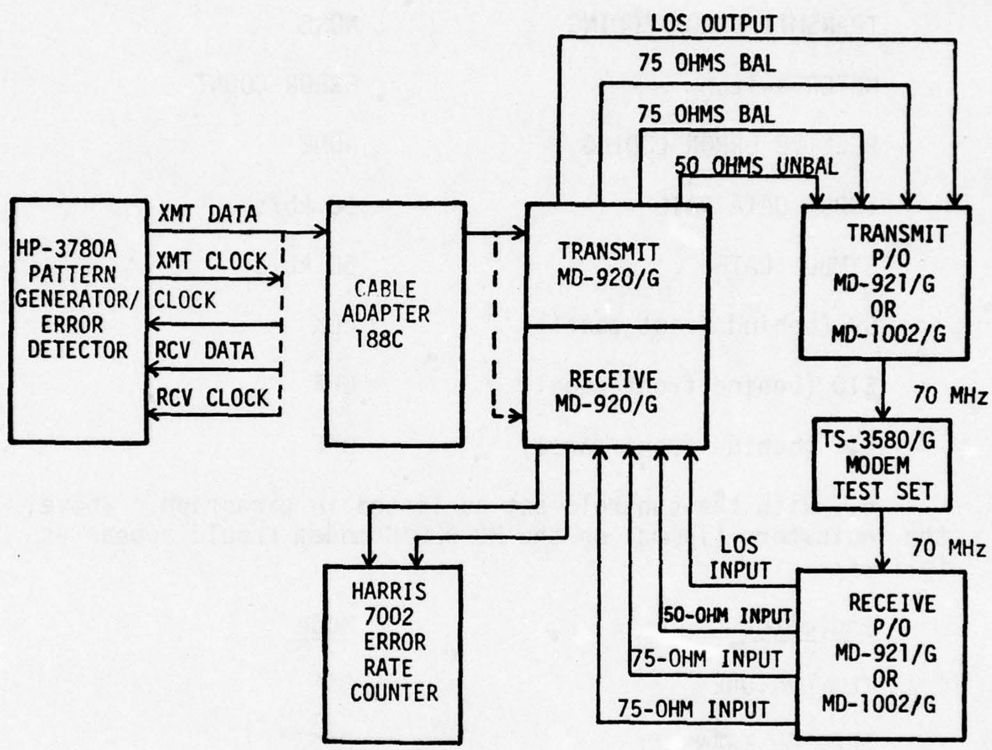


Figure 7-5. BER Test Configuration.

c. Set the controls on the MD-920/G ICF modem as follows (refer to figure 3-1, TM 11-5820-804-12):

Control	Setting
SOURCE	OPERATE
TRANSMIT ERROR CODING	NONE
METER switch	ERROR COUNT
RECEIVE ERROR CODING	NONE
INPUT DATA RATE	50 kb/s
SYMBOL RATE	50 kb/s
S9 (behind front panel)	CLK
S10 (behind front panel)	OFF
S11 (behind front panel)	OFF

d. With the controls set as listed in paragraph c above, the indicators (lamps) on the MD-920/G modem should appear as follows:

Indicator	Mode
TEMPERATURE	Off
SECTION TRANSMIT	Off
SECTION RECEIVE	Off
TRANSMIT BIT SYNCHRONIZER	Off
RECEIVE BIT SYNCHRONIZER	Off
DATA A	Off (logic 0) On (logic 1)
DATA B	Off (logic 1) On (logic 0)
CLOCK A	Off (logic 0) On (logic 1)
CLOCK B	Off (logic 1) On (logic 0)

e. The MD-921/G PSK modem LOS/cable driver output or LOS/ cable receiver and decoder input must be adjusted to the proper setting (LOS; cable, 75 ohms balanced or unbalanced; cable, 50 ohms unbalanced).

f. Set the controls on the MD-921/G PSK modem as follows (refer to figure 3-1, TM 11-5820-803-12):

Control	Setting
SOURCE	OPERATE
TRANSMIT ERROR CODING	NONE
INPUT DATA RATE	50 kb/s
RECEIVE ERROR CODING	NONE
SYMBOL RATE	50 kb/s
ALARM	ON
S9 (behind front panel)	ICF
S10 (behind front panel)	ON
S11 (behind front panel)	ON

g. With the controls set as listed in paragraph f above, the indicators (lamps) on the MD-921/G should appear as follows:

Indicator	Mode
TEMPERATURE	Off
SECTION TRANSMIT	Off
SECTION RECEIVE	Off
TRANSMIT POWER	Off
TRANSMIT BIT SNYC	Off
RECEIVE POWER	Off
PH LOCK	Off

Indicator	Mode
RECEIVE BIT SYNC	Off
CODER	Off

h. Adjust the block size of the HP-3780A to 10^6 and initiate the test.

i. Record the BER and alpha flunk, which should be equal to or not greater than the BER of the characterized PSK modem at the associated E_b/N_o level.

j. Adjust the E_b/N_o test set to an E_b/N_o of 19 dB and reduce it in 1-dB steps while measuring the BER and alpha flunk at each step.

k. Record the test data and plot a BER versus E_b/N_o curve. The curve should be identical to the characterized PSK modem.

7.8 PERFORMANCE TESTING OF MD-921/G OR MD-1002/G MODEM.

7.8.1 Purpose. The purpose of these tests is to measure the performance of the MD-921/G or MD-1002/G modem associated with the transmission and reception of automatic wideband secure voice communications.

7.8.2 Tests To Be Performed.

a. Output power level.

b. Frequency accuracy.

c. Demodulator dynamic range.

d. BER and alpha flunk versus E_b/N_o.

e. IF filter frequency response and dynamic range.

7.8.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Pattern generator/ error detector	HP-3780A	1	018
Frequency counter	HP-5340A	1	013

Test instrument	Model	Quantity	Code
RF millivoltmeter	Boonton 42B	1	021
Variable attenuators	HP-355C HP-355D	2 1	008 009
Modem test set	TS-3580/G	1	043
Spectrum analyzer	HP-141T	1	005
Signal generator	HP-8640B	1	019
Mixer	HP-10514A	1	002
Frequency selective voltmeter (FSVM)	HP-312D	1	023
Power meter	HP-436A	2	020
Power sensor	HP-8481A	2	040
Error rate counter	Harris 7002	1	017
Characterized modem	MD-921/G or MD-1002/G		

NOTE: All test equipment should be turned on and left energized during the entire testing stage, to allow for adequate warmup and to minimize shift.

7.8.4 Modem Precheck. Prior to performing the performance tests, the modem should be checked for proper operation in accordance with TM 11-5820-847-12, TM 11-5820-847-34, TM 11-5820-803-12, and TM 11-5820-803-34.

7.8.5 Output Power Level Measurement Procedure.

a. Configure the test equipment as shown in figure 7-6.

b. Turn on the test equipment and allow for a 30-minute warmup and stabilization period.

c. Tune the modem for the appropriate data rate (50 kb/s used for discussion) and record all identification information.

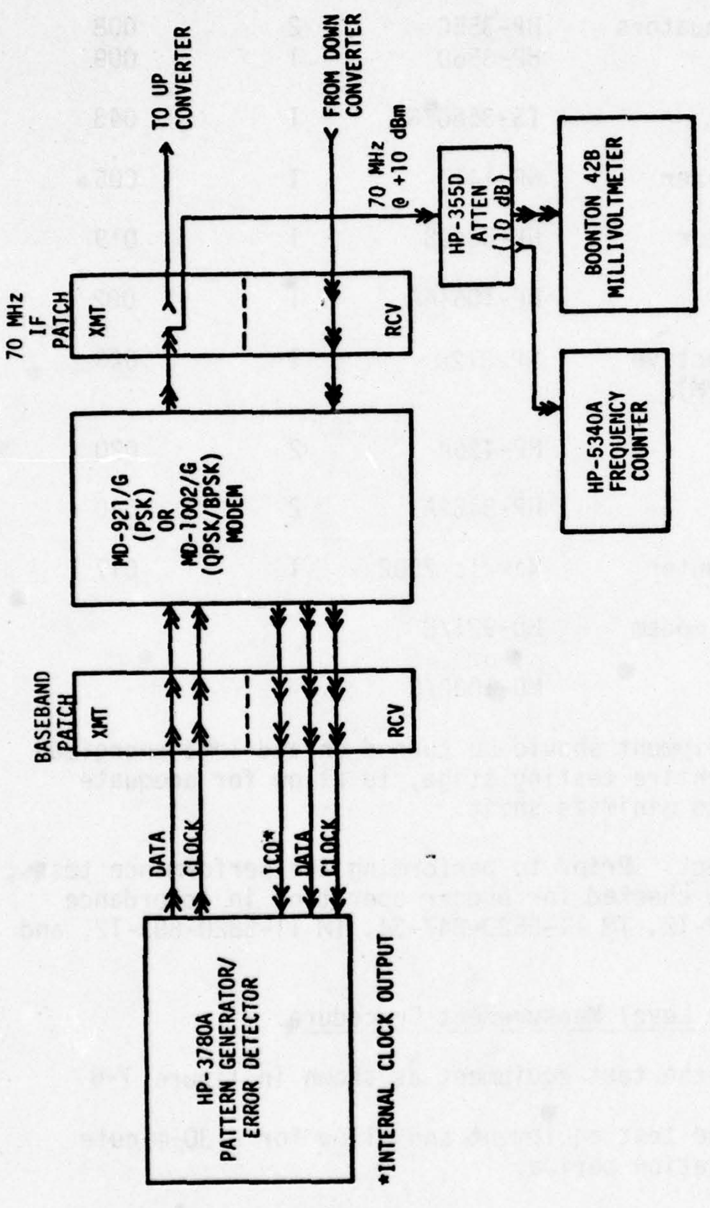


Figure 7-6. Output Power Level and Frequency Accuracy Test Configuration.

d. Configure the modem for wideband operation, using internal differential coding and binary phase shift keying (BPSK). Record the RF millivoltmeter (mVM) indications in dBm and millivolts. The mVM should read 0 dBm, ± 1 dB.

e. Configure the modem for a continuous wave (CW) output and record the power reading. The variation between the two readings should not exceed ± 1 dB.

7.8.6 Output Frequency Accuracy.

a. Configure the test equipment as shown in figure 7-6.

b. Turn on the test equipment and allow for a 30-minute warmup and stabilization period.

c. Tune the modem for the appropriate data rate (50 kb/s used for discussion) and record all identification information.

d. Configure the modem for a CW output and record the output frequency from the frequency counter. The frequency counter should read 70 MHz ± 1 kHz.

7.8.7 Demodulator Dynamic Range.

a. Configure the modem for wideband operation with an IF loopback through the TS-3580/G modem test set as shown in figure 7-7.

b. Configure the HP-3780A pattern generator/error detector controls as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZEROS ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	009
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^6
INPUT FORMAT	BINARY

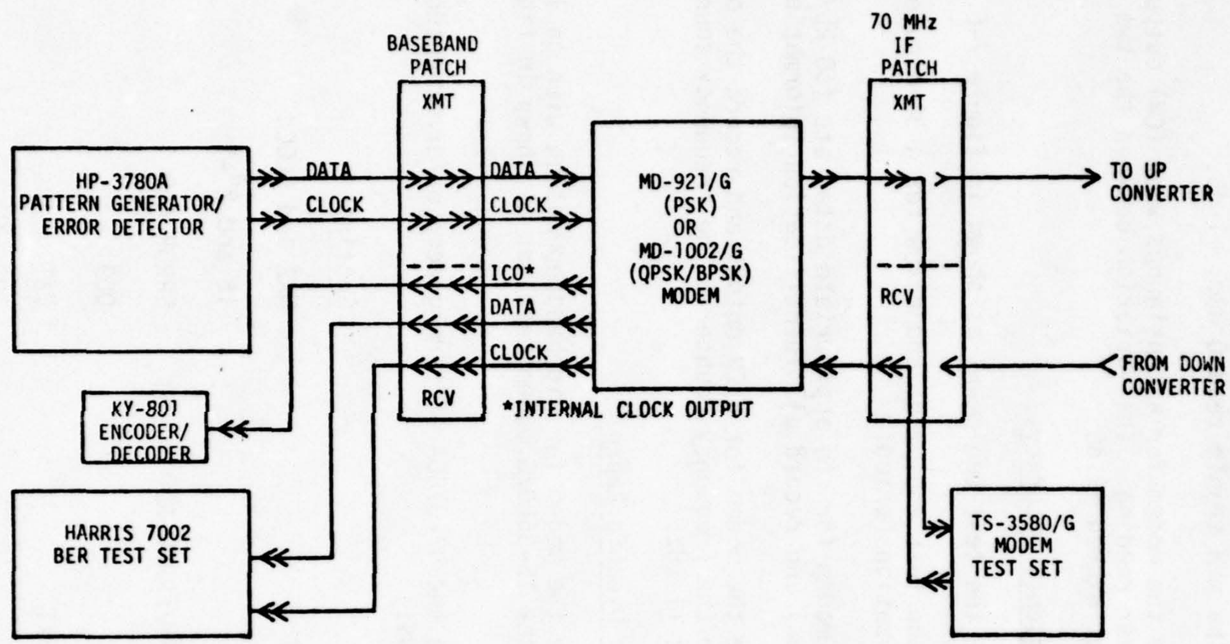


Figure 7-7. Demodulation Dynamic Range Configuration.

Control	Setting
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

c. Configure the TS-3580/G modem test set controls as follows:

(1) Microwattmeter assembly.

Control	Setting
OFF/PWR/dBm switch	OFF
ZERO adjustment	N/A
CAL FACTOR switch	0 dB
FULL SCALE and AUTO switches	Not used

(2) Programmable carrier/noise test set assembly.

Control	Setting
POWER switch	OFF
OPERATE/CALIBRATE/ZERO switch	OPERATE
E_B/N_0 switch	15.0
DATA RATE switch	70.0

(3) Turn-on procedure.

(a) Set the microwattmeter assembly OFF/PWR/dBm switch to dBm.

(b) Depress the test set assembly POWER switch.

(c) Allow a few minutes for the equipment to stabilize.

(d) Set the test set assembly OPERATE/CAL/METER ZERO switch to METER ZERO and adjust the microwattmeter assembly ZERO adjust control to the zero line on the analog meter.

(e) Connect the modulator output of the modem under test to the test set input.

(f) Connect the demodulator input of the modem under test to the test set output.

(g) Set the test set assembly OPERATE/CAL/METER ZERO switch to the CAL position and observe the power reading on the microwattmeter assembly. It should read 0 dBm ± 1 dB.

(NOTE: If the microwattmeter reading is greater than 0 dBm, an external attenuator of appropriate value must be connected between the modulator output and the test set input. If the power reading is appreciably less than -1 dBm, the ability of the test set to properly adjust to higher values of C/N_0 will be impaired.)

(h) Switch the OPERATE/CAL/METER ZERO switch to the OPERATE position.

(i) The test set is now ready for use.

(4) Operation.

(a) Set the DATA RATE (DR) thumbwheel switches to a numerical value between 18.8 and 73, which equals 10 log DR.

(b) Set the E_B/N_O thumbwheel switches to a value between 0 and 19.9 dB as required for the test.

(c) With the OPERATE/CAL/ZERO switch in the OPERATE position, observe the POWER METER digital reading. It will alternately read NOISE at approximately -30 dBm and CARRIER at some value between -7 and -45 dBm, depending upon the E_B/N_O and DR switch settings. When the carrier value has stabilized for several successive readings to within 0.1 dB, the instrument is ready for modem testing. (NOTE: After any readjustment of the DR or E_B/N_O switches, the power meter should be checked for stabilized carrier readings before continuing a test program.)

(d) Adjust the TS-3580/G to establish an E_b/N_o of 19 dB at 50 kbs. The noise bandwidth should be adjusted to 46.99 dB; that is, noise bandwidth equals 10 log DR (50 kb/s).

(e) In some cases, more than one wideband secure voice subscriber (WBSVS) may be accessing the same modem through multiplexing or data stream interleaving. Therefore, the data rates and symbol rates may differ from 50 kb/s (for example, WBSVS No. 1 plus WBSVS No. 2 at 50 kb/s each equals 100 kb/s).

(f) Ensure that all modem indicators are normal. Record the signal-to-noise (S/N) reading and the automatic gain control (AGC) volts reading as indicated on the modem meter panel.

(g) Decrease the E_b/N_o in 2-dB steps while denoting the AGC and S/N indicators at each step until an E_b/N_o of 0 dB is reached.

(h) Denote the E_b/N_o at which the phase-lock, power, and receive bit sync lamps on both the modem and HP-3780A light or flash, as applicable.

(i) Increase the E_b/N_o until the phase-lock, power, and receive bit sync lamps extinguish or stop flashing, while also measuring the S/N and AGC readings.

(j) Adjust the modem for BPSK modulation, employing external Viterbi coding and a symbol rate of 100 kb/s.

(k) Ensure that all modem indications are normal and that the KY-801 code-c is in sync and lock.

(l) Repeat steps (c) through (h) above, while also denoting the E_b/N_o at which the KY-801 lost sync or became ineffective.

(m) Figure 7-8 shows typical performance values for S/N versus E_b/N_o. The AGC versus E_b/N_o data should be used for baseline purposes and to denote effective or abnormal AGC actions.

(n) Record the test results and plot E_b/N_o versus S/N and E_b/N_o versus AGC curves.

7.8.8 <u>BER and Alpha Flunk Versus E_b/N_o Looped Back at IF Patch</u>.

7.8.8.1 <u>Loopback without IF filters</u>.

a. Configure the test equipment as shown in figure 7-9, with the IF filters bypassed.

b. Turn on the equipment and allow for a 30-minute warm-up period.

c. Adjust the TS-3580/G modem test set for an E_b/N_o of 19 dB.

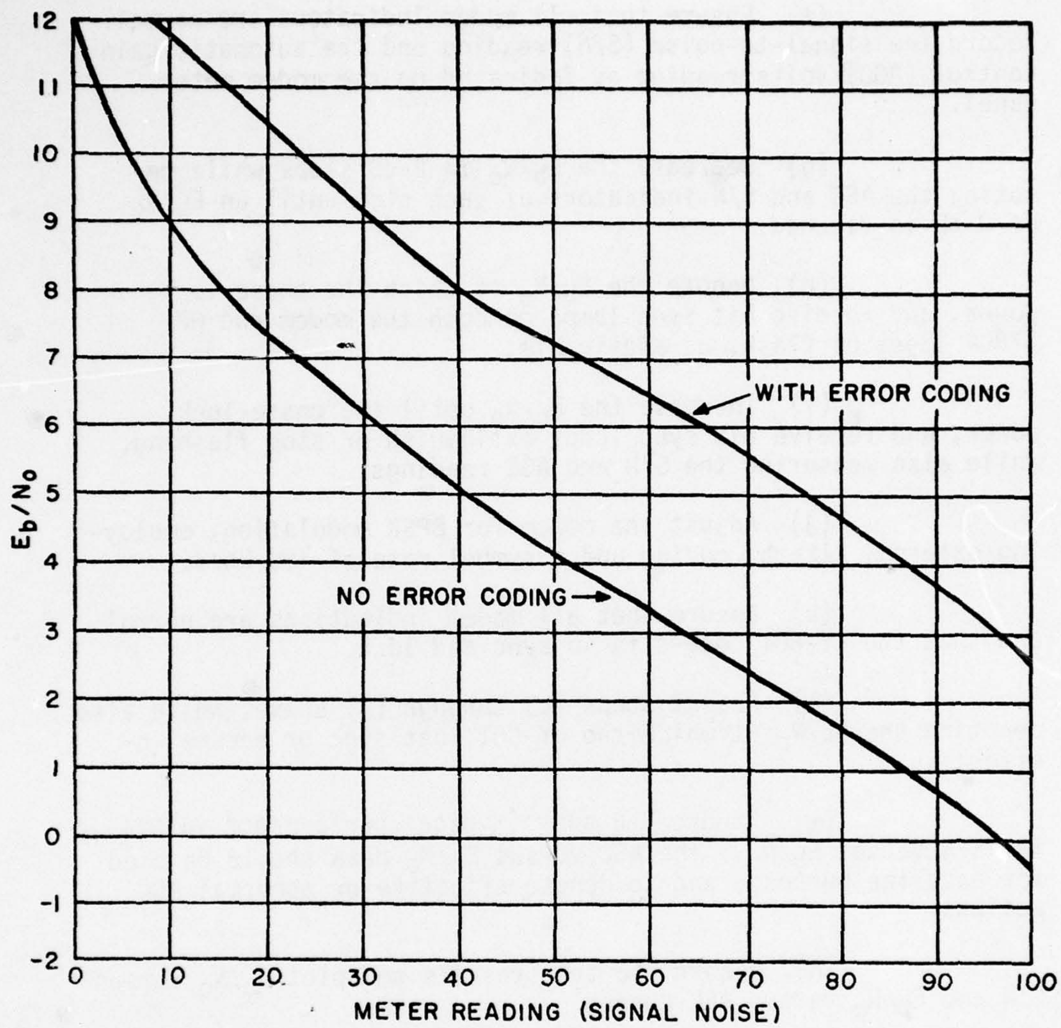
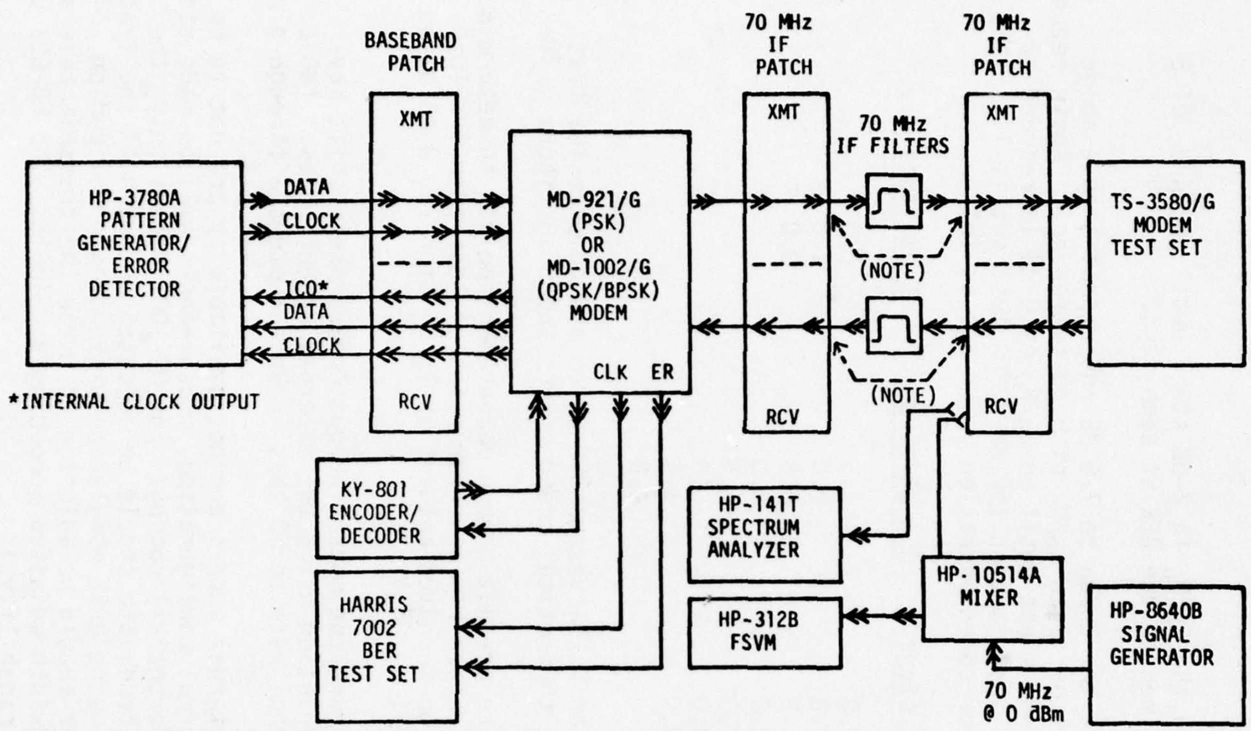


Figure 7-8. Typical Performance Values for S/N Versus E_b/N_o.



NOTE: THE IF FILTERS SHOULD BE BYPASSED WITH PATCH CABLES FOR THE FIRST MEASUREMENT ONLY.

Figure 7-9. BER and Alpha Flunk Versus E_b/N_o with Filters Looped Back at IF Patch.

d. Push the START button on the HP-3780A and Harris 7002 BER test sets. Record the bit error rate and the alpha flunk readings.

e. Reduce the E_b/N_o in 2-dB steps until an E_b/N_o of 8 dB is reached; record the BER at each step.

f. Reduce the E_b/N_o to 7.5 dB and repeat step e above in 0.5-dB steps until an E_b/N_o of 3 dB is reached. Again reduce the E_b/N_o in 1-dB steps until an E_b/N_o of 0 dB is reached or until the sync loss lamp on the HP-3780A test set is lit. The E_b/N_o levels for coded operation in dB are as follows:

2-dB steps	0.5-dB steps	1-dB steps
19.0	7.5	2.0
17.0	7.0	1.0
15.0	6.5	0.0
13.0	6.0	
11.0	5.5	
9.0	5.0	
8.0	4.5	
	4.0	

g. Plot an E_b/N_o versus BER curve and compare the test results to the theoretical coded curves shown in figure 7-10.

(NOTE: If there are not enough measurement points to determine the threshold accurately at error rates of less than 1×10^{-6}, the test must be repeated between an E_b/N_o of 8 and 3 dB using block sizes of 1×10^8.)

h. Configure the modem for quaternary phase shift keying (QPSK) modulation using the external KY-801 codes. (NOTE: Adjust the symbol rate to 50 kb/s.) Repeat steps a through g above.

i. If external coders are not available or are not to be used in the normal configuration, measurements will be made using internal (differential) coding. For MD-1002 modems only, the receive noise bandwidth should be adjusted to one-half the transmit data rate using QPSK modulation without external coding. The MD-921 receiver should be adjusted to twice the transmit rate and the noise bandwidth adjusted accordingly. (NOTE: The MD-921 does not have QPSK capability.)

j. The most efficient modem configuration is for QPSK externally coded operations, which provide the best quality communications with minimum expenditures of satellite bandwidth and power.

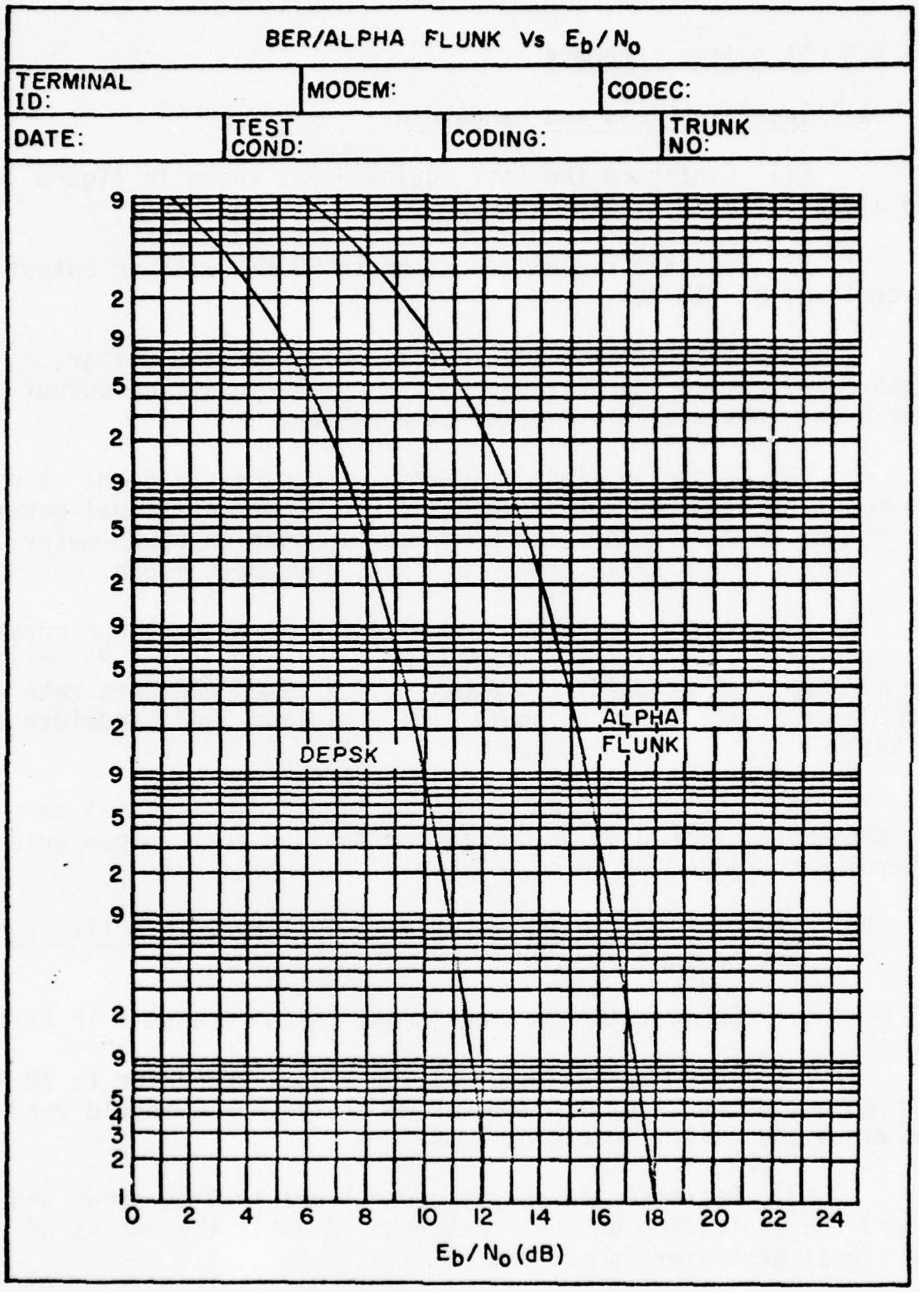


Figure 7-10. Typical BER/Alpha Flunk Curves.

7.8.8.2 IF filter precheck.

a. Insertion loss and bandwidth.

(1) Configure the test equipment as shown in figure 7-11 and allow for a 30-minute warmup.

(2) Tune the signal generator to 70 MHz with an output power level of +10 dBm.

(3) To determine the insertion loss of the filter, measure and record the difference between the input and output levels and subtract the external attenuation.

(4) Vary the signal generator frequency in 5-kHz steps above and below 70 MHz while maintaining a constant signal generator output level. Record the power level shown on power meter No. 2 at each step until the 3-dB points have been found.

(5) Plot a frequency versus power level response curve as shown in figure 7-12 and record the 3-dB bandwidth. Normally, the minimum 3-dB bandwidth is equal to 1.2 times the data rate (for example, a 50-kb/s filter should have a minimum 3-dB bandwidth of 60 kHz).

(6) The calculated values derived from steps (3) through (5) above should be used to denote substandard performance unless otherwise specified.

b. Dynamic range (pertains only to filters with active components).

(1) Connect the test equipment to the transmit IF filter.

(2) Tune the frequency of the signal generator to 70 MHz with an output level of +10 dBm. Power meter No. 2 should read +2 dBm minus the filter insertion loss.

(3) Decrease the output power level in 2-dB steps and record the indication on power meter No. 2 until the output of the signal generator is -20 dBm.

(4) Plot a curve showing input-to-output power. The curve should be linear to within ±0.25 dB.

(5) If gain compression exceeds 0.25 dB, indicate the compression point on the curve and compare the test results to the output power level of the modem that was previously taken.

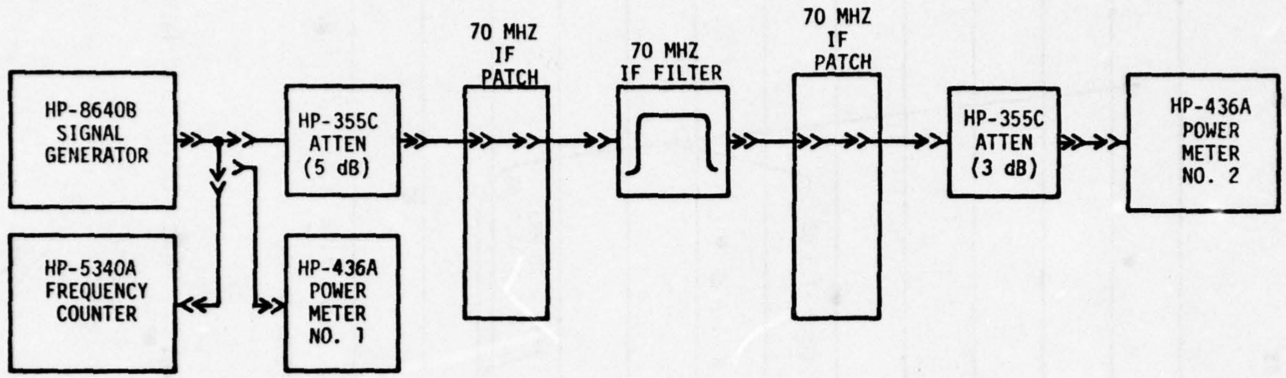


Figure 7-11. IF Filter Insertion Loss/Gain and Response (3-dB Bandwidth) Measurement Configuration.

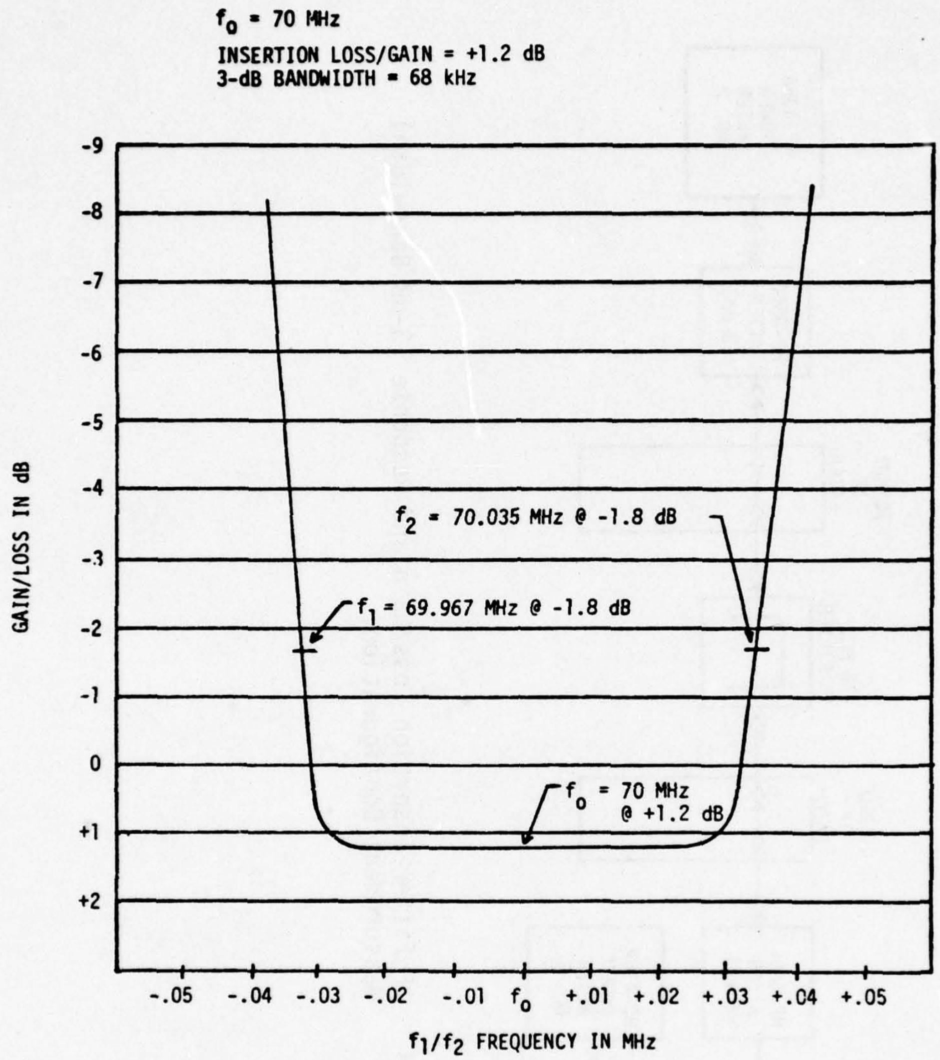


Figure 7-12. Example of Frequency Versus Power Level and Response Curve.

(6) If the modem output level is in the compression area of the filter, an appropriate attenuator must be inserted in series with the modem output, or the internal attenuator of the filter must be adjusted.

(7) Connect the test equipment to the receive IF filter and repeat steps (2) through (4) above.

(8) If gain compression exceeds 0.25 dB, indicate the compression point on the curve and compare the test results with the down converter power output level.

(9) If the down converter output level is in the compression area, the down converter IF attenuators or the IF filter internal attenuators must be adjusted. The down converter output level should remain below the IF filter compression range while maintaining enough power for the modem's demodulator to provide proper AGC performance.

c. Back-to-back passband ripple.

(1) Connect the transmit and receive filters back-to-back as shown in figure 7-13.

(2) Adjust the signal generator to slowly sweep the filter 50-kHz passband and note the amount of ripple in the passband.

(3) The ripple should be less than 0.5 dB within the 50 kHz passband.

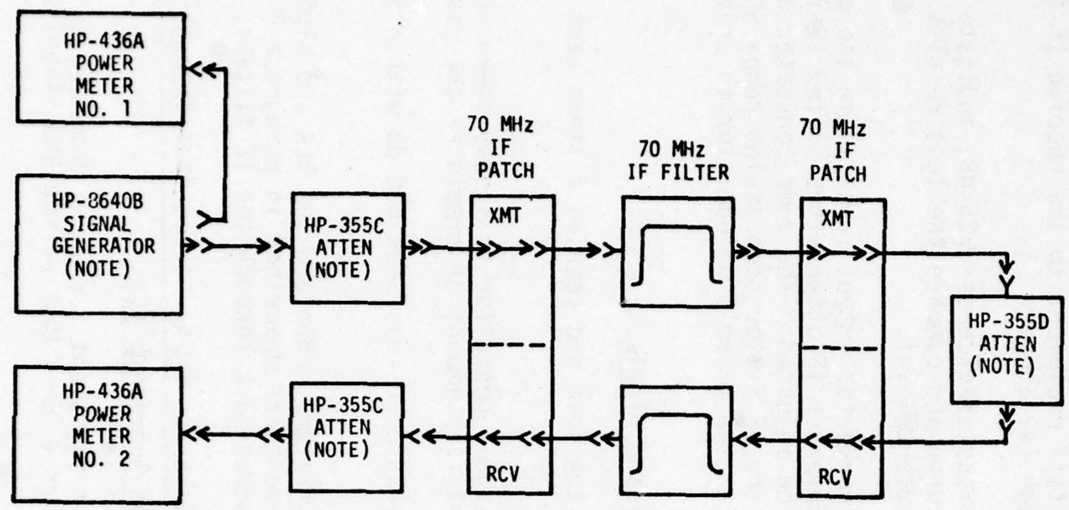
7.8.8.3 Loopback with IF filters. Perform the BER and alpha flunk versus E_b/N_o measurements as described in paragraph 7.8.8.1 with the E_b/N_o test set looped back through the IF filters.

7.8.9 BER and Alpha Flunk Versus E_b/N_o Looped Back Through Frequency Conversion Subassembly.

a. Configure the test equipment for an RF loopback as shown in figure 7-14 and allow for a 30-minute warmup and stabilization period.

b. Tune the up converter to the allocated uplink frequency and the down converter to 25 MHz below the uplink frequency.

c. Configure the modem for a CW output and adjust the up converter output attenuator and the self-test translator (STT) attenuator until a received carrier-power-to-noise-power density ratio (C/kT) of 65.98 dB is seen on the receive side, as measured in accordance with the procedures in appendixes A and B.



NOTE: ADJUST THE SIGNAL GENERATOR OUTPUT LEVEL AND ATTENUATORS TO THE OPERATIONAL LEVELS OF THE MODEM AND DOWN CONVERTER.

Figure 7-13. IF Filter Back-to-Back Passband Ripple.

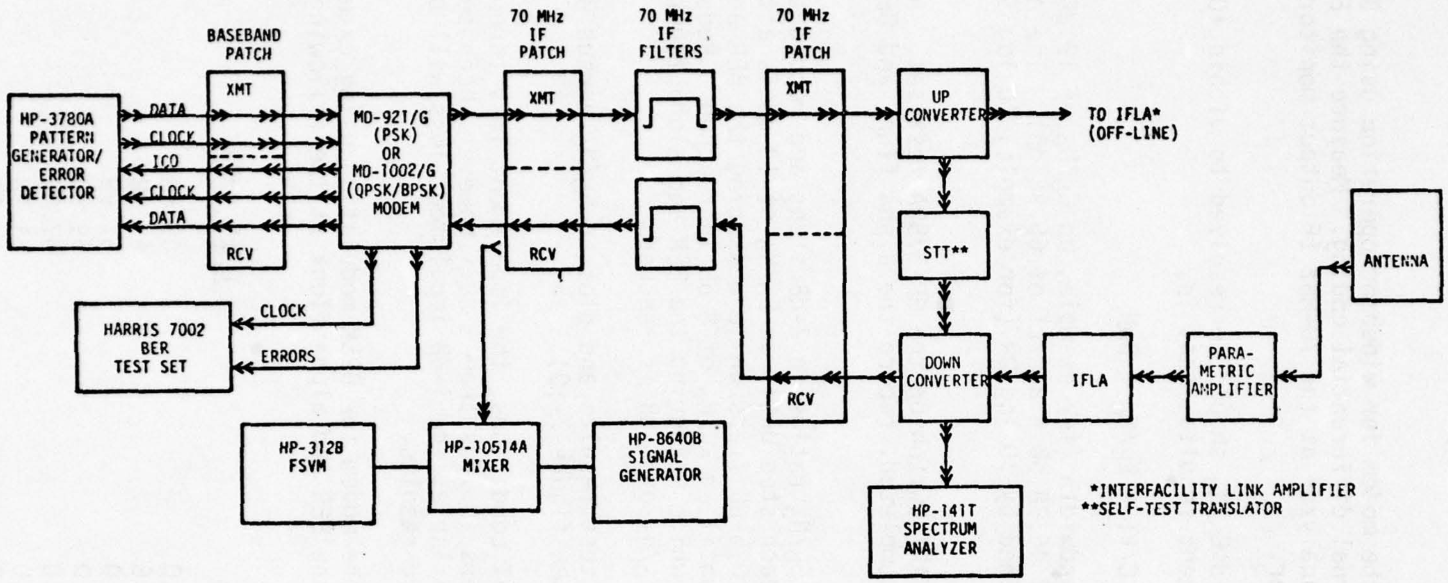


Figure 7-14. BER and Alpha Flunk Versus E_b/N_o Using RF Loopback Through Converters and Sky Noise.

d. Configure the modem for wideband operation using BPSK modulation and internal differential coding. Measure the E_b/N_o using the spectrum analyzer at the 70-MHz IF output monitor plug on the down converter.

e. The measured E_b/N_o should be resolved to within $\pm$0.5 dB of the C/kT measurement results; that is,

$$C/kT = E_b/N_o + BwN$$

where BwN = noise bandwidth (for example, an E_b/N_o of 19 dB plus a noise bandwidth of 46.98 dB = a C/kT of 65.98 dB). The noise bandwidth is determined by 10 log DR (for example, 10 log 50 kb/s = 46.98 dB).

f. Push the START button on the HP-3780A test set. After the measurement is completed, record the alpha flunk and BER indications.

g. Reduce the E_b/N_o ratios in 2-dB steps and record the BER and alpha flunk at each step until an E_b/N_o of 13 dB is attained. Reduce the E_b/N_o in 0.5-dB steps while measuring the BER and alpha flunk at each step until an E_b/N_o of 8 dB is reached. Reduce the E_b/N_o in 2-dB steps while measuring the BER and alpha flunk at each step until an E_b/N_o of 0 dB is reached.

h. Record the test results and plot an E_b/N_o versus BER and alpha flunk curve (see figure 7-10).

i. Under normal conditions, the impairment loss through the up and down converters is less than 1 dB. However, because there are no standards available, the 1-dB impairment loss will be used to denote substandard results.

j. Configure the modem for BPSK modulation using external coding and measure the BER and alpha flunk at the following E_b/N_o or C/kT ratios:

E_b/N_o	C/kT (dB)
19.0	65.98
17.0	63.98
15.0	61.98
13.0	59.98
11.0	57.98
9.0	55.98
8.0	54.98
7.5	54.48
7.0	53.98

E_b/N_o (dB)	C/kT (dB)
6.5	53.48
6.0	52.98
5.5	52.48
5.0	51.98
4.5	51.48
4.0	50.98
2.0	48.98
0.0	46.98

k. Repeat steps g through h above.

l. Configure the modem for QPSK modulation using external coding and repeat the BER and alpha flunk versus E_b/N_o at the E_b/N_o ratios stated above. (NOTE: This portion of the procedure is not applicable to the MD-921.)

7.8.10 BER and Alpha Flunk Versus E_b/N_o with Loopback at Distant Earth Terminal.

a. Request permission from the satellite controller to access the satellite at the allocated test frequency and a suitable power level to attain a downlink C/kT of 65.98 dB.

b. Upon Defense Communications Agency (DCA) approval to access the satellite, tune the down converter to a frequency that is 200 or 725 MHz below the uplink frequencies at each earth terminal, as applicable to earth coverage (EC) or narrow beam (NB) satellite operation.

c. Configure the earth terminals as shown in figure 7-15 and adjust the modems for BPSK modulation using differential coding and CW output at both terminals.

d. Adjust the uplink power output levels until a C/kT of 65.98 dB is attained at each terminal. Configure the modems for wideband operation and measure the E_b/N_o ratios. The E_b/N_o ratios should coincide with the C/kT ratios ± 0.5 dB.

e. Measure the BER and alpha flunk at each station. Repeat this test at the following E_b/N_os:

19.0	12.5	10.5	8.0
17.0	12.0	10.0	6.0
15.0	11.5	9.5	4.0
13.0	11.0	9.0	2.0
		8.5	0.0

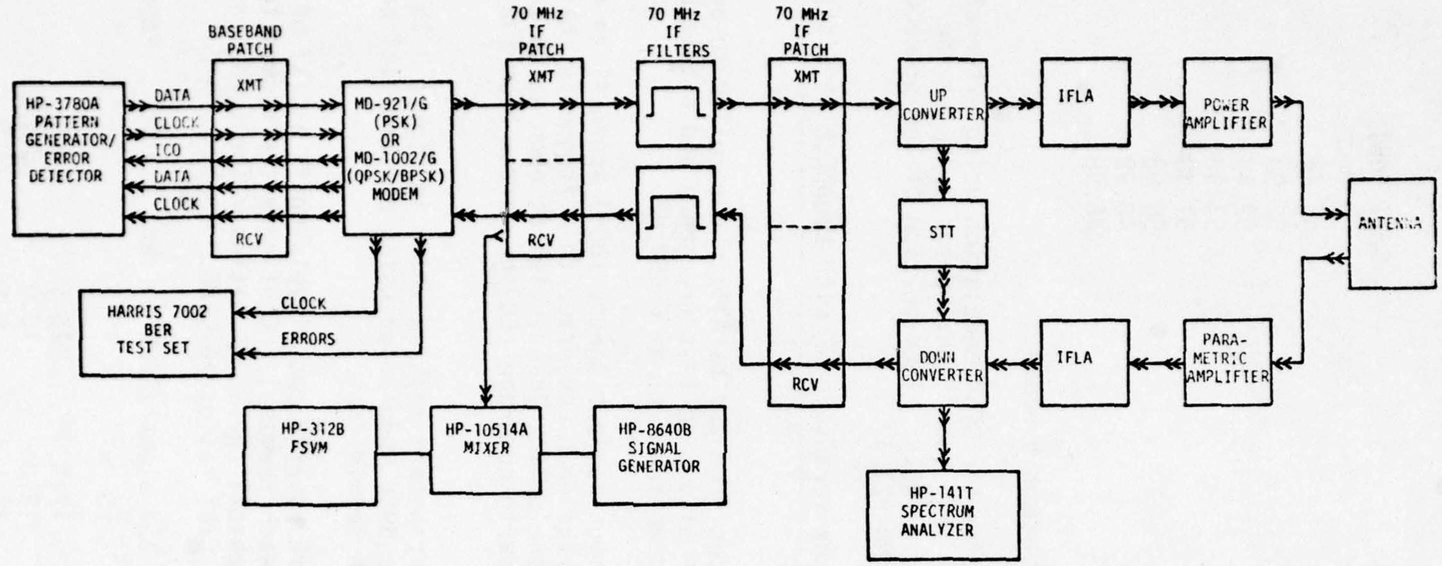


Figure 7-15. BER and Alpha Flunk Versus E_b/N_o Using Loopback from Distant Earth Station.

f. Record and analyze the test results. The impairment losses in a satellite loopback should not exceed 3.4 dB.

g. Repeat steps e and f with the modems configured for BPSK modulation using externally coded operation. Record the test results and plot a curve of BER and alpha flunk versus E_b/N_o (see figure 7-10).

h. Configure the modems for QPSK modulation (MD-1002 only), employing external coding, and repeat steps e and f. Record the test results and plot a curve of BER and alpha flunk versus E_b/N_o.

i. Tune the down converters to the allocated downlink frequency. The modems should still be configured for externally coded QPSK operation.

j. At each terminal, increase the output power until an E_b/N_o of 19 dB is measured on the receive side at each earth terminal.

k. Measure the BER and alpha flunk at the following E_b/N_o. Record the test results and plot a curve of BER and alpha flunk versus E_b/N_o.

19.0	11.0	6.5	4.5
17.0	9.0	6.0	4.0
15.0	7.5	5.5	2.0
13.0	7.0	5.0	0.0

l. Repeat steps j and k with the modems configured for BPSK modulation using external coding and again without external coding.

m. The impairment losses end-to-end through the satellite should not exceed 3.4 dB.

7.9 PERFORMANCE TESTING OF MULTIPLEXER SET AN/GSC-24(V).

7.9.1 Purpose. The purpose of these tests is to measure the performance of AN/GSC-24(V) TDM sets associated with transmission and reception of wideband secure voice communications traffic.

7.9.2 Tests To Be Performed. The tests to be performed are as follows:

a. Receive/transmit (RT) card calibration.

b. Phase and amplitude jitter (S/N) measurement.

c. Bit error rate measurement.

7.9.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Pattern generator/ error detector	HP-3780A	1	018
Oscilloscope	Tektronix 7603	1	029
Oscilloscope amplifier	Tektronix 7A22	1	007
Frequency counter	HP-5340A	1	013

7.9.4 Multiplexer Set Operational and Alarm Precheck.

a. Set the POWER CONTROL switch on the AN/GSC-24(V) to the ON position, and press the POWER CONTROL CIRCUIT BREAKER switch to ensure that it is on. Other indicators may also be lighted.

b. Check the multiplexer test set for normal operation in accordance with the procedures in chapter 3 of TM 11-5805-688-14-1.

c. Press the front panel LAMP TEST switch and observe that all front panel indicators are lit and the number 88 appears in the FAULT LOCATION display.

d. Release the LAMP TEST switch. If all requirements are met, proceed with the performance measurements.

7.9.5 RT Card Calibration.

a. Calibration of the RT card is performed to ensure that the output frequencies of the reference timing and transition encoding oscillators are within prescribed tolerances (± 1 Hz).

b. Turn on the frequency counter and allow for a 15-minute warmup and stabilization period.

c. Loosen and remove the printed circuit access cover located at the front of the AN/GSC-24(V).

(NOTE: Steps d through f are applicable only when the multiplexer is operating from an internally generated reference timing signal. If the multiplexer is operating from a station clock or other external reference timing signal, proceed to step g.)

d. Configure the test equipment as shown in figure 7-16 and measure the output frequency of oscillator Y-1 (TP-10).

(NOTE: The multiplexer set is initially delivered with a reference timing oscillator with a nominal output frequency of 9.8304 MHz. For certain applications, oscillators of different frequencies may be installed. If the frequency measured at TP-10 is not approximately 9.8304 MHz, determine the specified nominal frequency of the installed oscillator before proceeding.)

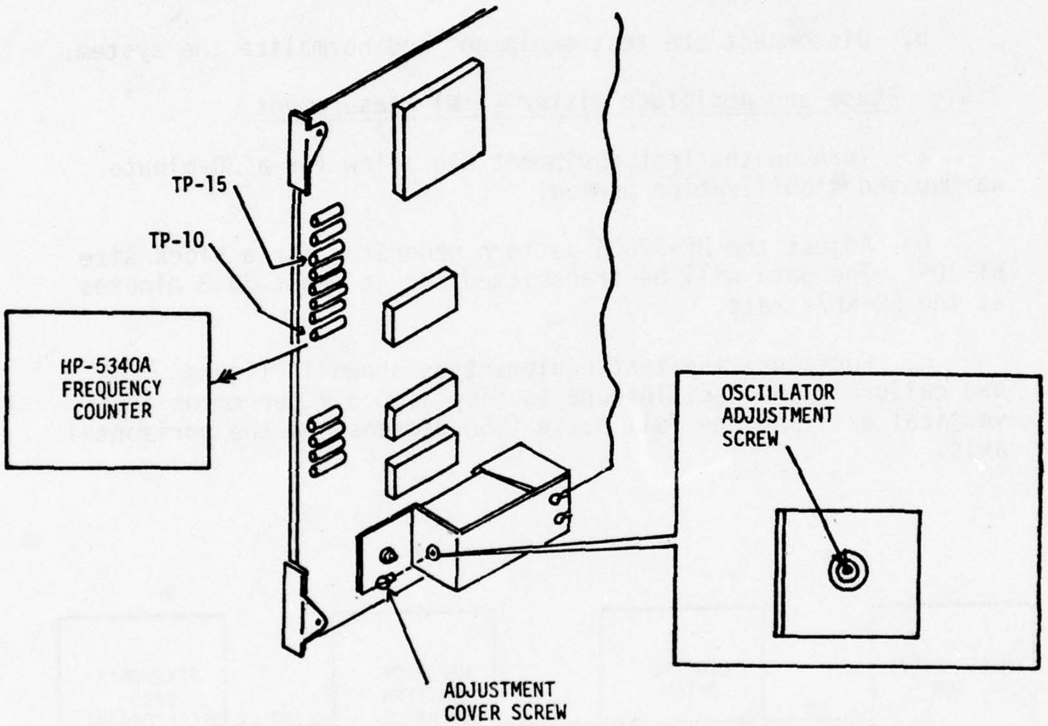


Figure 7-16. RT Card Calibration.

e. Record the test frequency and determine if it is in tolerance. The tolerance should be determined as follows:

$$\text{Frequency tolerance} = \pm \frac{\text{nominal frequency}}{10^7} \text{ Hz}$$

$$= \pm \frac{9.8304 \times 10^6}{10^7} \text{ Hz}$$

$$= \pm 0.98304 \text{ Hz.}$$

f. If the frequency is not in tolerance, use a standard screwdriver to remove the protective cover from the RT card reference timing oscillator adjustment control (figure 7-16). Using a nonmetallic electronic tuning tool, slowly rotate the oscillator adjustment control until the frequency measured at TP-10 on the RT card is within the tolerance established in step e above. Replace the protective cover.

g. Connect the frequency counter to TP-15 of the RT card and measure and record the frequency of the transition encoding signal. The frequency should be 4800 $\pm$0.25 Hz.

h. Disconnect the test equipment and normalize the system.

7.9.6 Phase and Amplitude Jitter (S/N) Measurement.

a. Turn on the test equipment and allow for a 30-minute warmup and stabilization period.

b. Adjust the HP-3780A pattern generator for a block size of 10^8. The data will be transmitted for at least 33.3 minutes at the 50-kb/s rate.

c. Configure the test equipment as shown in figure 7-17 and calibrate the oscilloscope to display 0.5 V per cm on the vertical axis and one full pulse (360 degrees) on the horizontal axis.

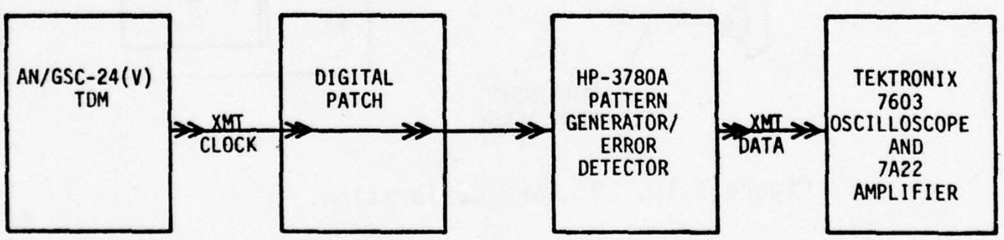


Figure 7-17. Phase and Amplitude Jitter (S/N) Measurement of AN/GSC-24(V) Clock.

d. Measure and record the amplitude jitter in V p-p and the phase jitter in degrees. The amplitude jitter will appear as a smear riding on the top of the pulse, while phase jitter will appear as a smear on the leading or trailing edge of the pulse. See figure 7-18 below.

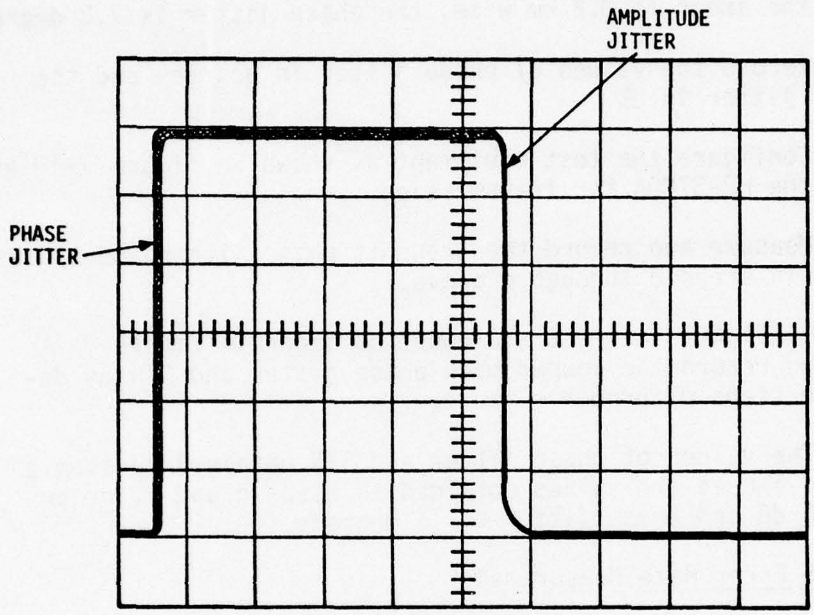


Figure 7-18. Typical Oscilloscope Display of Amplitude and Phase Jitter.

e. Compute and record the dB equivalent of the amplitude jitter. The dB equivalent is derived by taking 20 log of the peak value of the smear divided by the peak value of the pulse:

Smear = 0.1 V p-p = 0.05 V peak

Pulse = 6 V p-p = 3 V peak

$$S/N \text{ (in dB)} = 20 \log \frac{0.05}{3.0} = -35.56 \text{ dB.}$$

Normally, the amplitude jitter is too low (less than -50 dB) to be measured.

f. The phase jitter is determined by taking the width of the smear on either the leading or trailing edges of the pulse and comparing it to the calibration of the scope. For example, if the scope is calibrated so that one full pulse equals 10 cm, then 1 cm equals 36 degrees and 0.1 cm equals 3.6 degrees. Therefore, if the smear is 0.2 cm wide, the phase jitter is 7.2 degrees.

g. Record the values of phase jitter in degrees and the amplitude jitter in dB.

h. Configure the test equipment as shown in figure 7-19 and initiate the HP-3780A for transmission.

i. Measure and record the transmit phase jitter and S/N as described in steps d through g above.

j. Configure the test equipment as shown in figure 7-20. Measure and record the looped back phase jitter and S/N as described in steps d through g above.

k. The values of phase jitter and S/N obtained in step j should not exceed the values obtained in steps g and i, or an S/N of -30 dB and phase jitter of 15 degrees.

7.9.7 <u>Bit Error Rate Measurement</u>.

a. Configure the test equipment as shown in figure 7-21 and ensure that all other user inputs are properly terminated.

b. Adjust the HP-3780A pattern generator for a block size of 10^8.

c. Initiate the BER test and record the test results. No errors should be encountered.

d. If other users are normally assigned to the multiplexer system, connect them in, one at a time, and measure the BER after each additional user is connected. No increase in BER should be encountered.

7.10 <u>PERFORMANCE TESTING OF GROUP DATA MODEM AN/USC-26</u>.

7.10.1 <u>Purpose</u>. The purpose of these tests is to measure the performance of AN/USC-26 group data modems associated with the transmission and reception of automatic wideband secure voice communications.

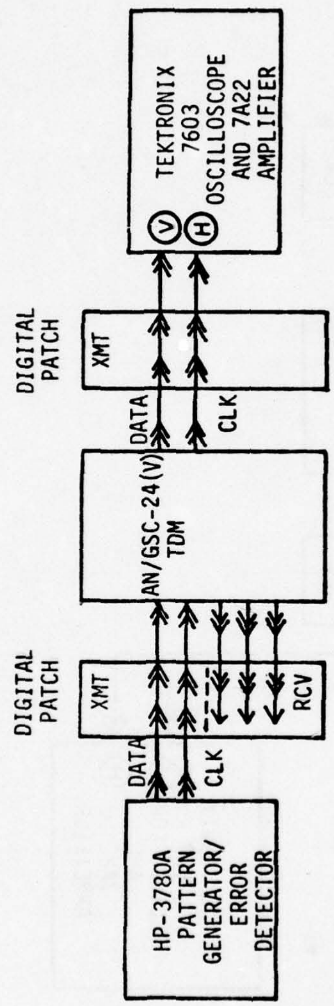


Figure 7-19. Phase and Amplitude Jitter (S/N) Measurement of AN/GSC-24(V) Transmit Data.

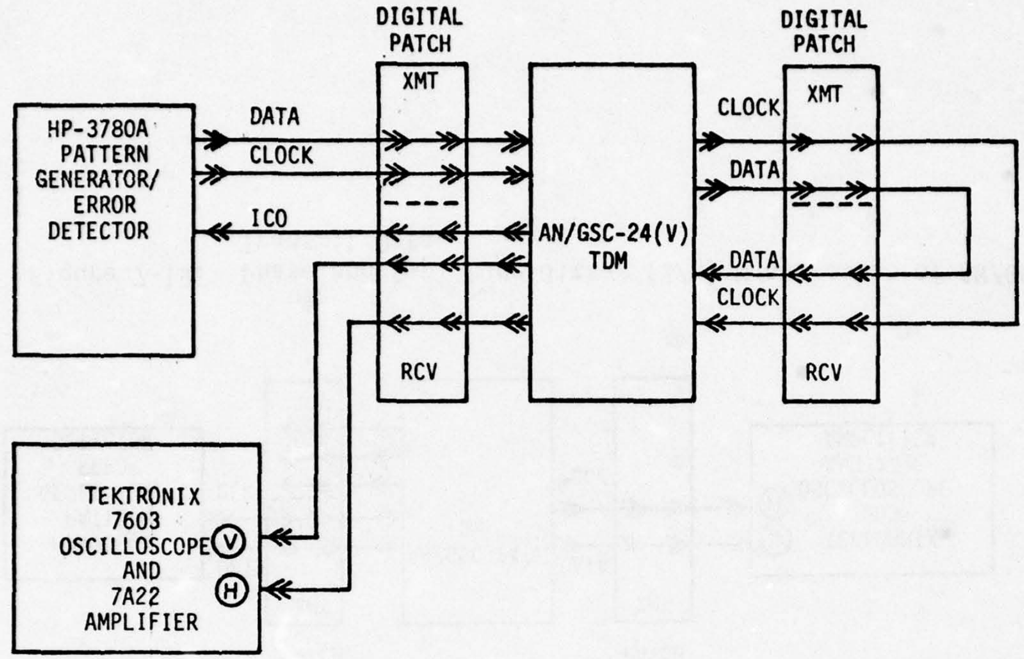


Figure 7-20. Phase and Amplitude Jitter (S/N) Measurement of AN/GSC-24(V) Loopback.

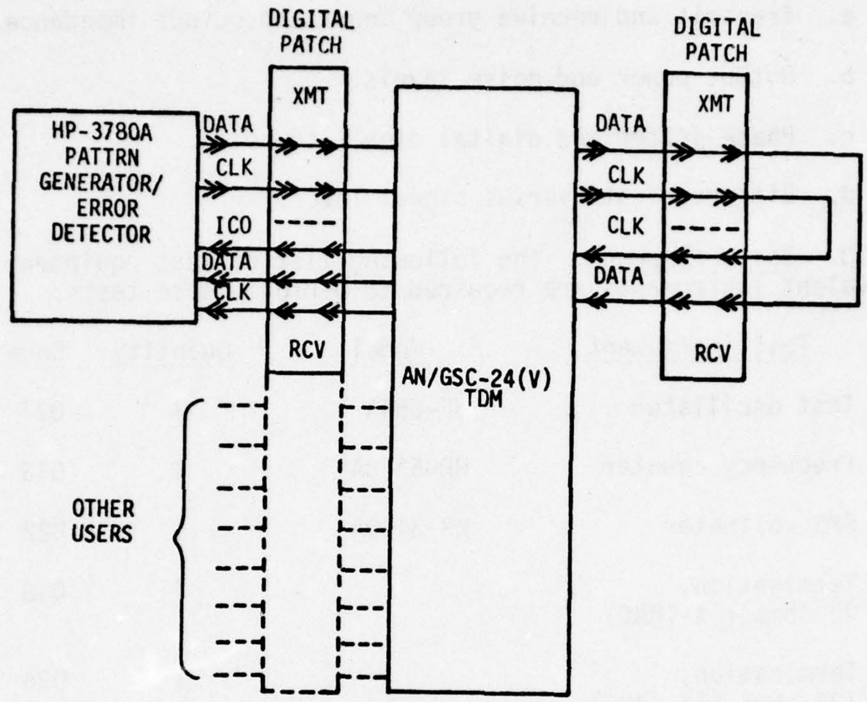


Figure 7-21. BER Measurement of AN/GSC-24(V) Loopback.

7.10.2 <u>Tests To Be Performed</u>. The tests to be performed are as follows:

a. Transmit and receive group input and output impedance.

b. Output power and noise levels.

c. Phase jitter and digital signal-to-noise.

d. Bit error rate versus signal level.

7.10.3 <u>Test Equipment</u>. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	027
Frequency counter	HP-5340A	1	013
RMS voltmeter	HP-3400A	1	022
Termination, 75 ohms ±1% (BNC)		1	038
Termination, 135 ohms ±1% (BNC)		1	036
Termination, 150 ohms ±1% (BNC)		1	012
Pattern generator/ error detector	HP-3780A	1	018
Oscilloscope	Tektronix 7603		029
Oscilloscope amplifier	Tektronix 7A22	1	007

7.10.4 <u>Transmit and Receive Group Input and Output Impedance</u>.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period.

b. Prior to operating the AN/USC-26 modem, ensure that strapping options and front panel controls are compatible with the remote and terminal equipment.

c. Determine the nominal impedance strapping of the AN/GSC-24(V) group input and output, and adjust the HP-654A test oscillator for the same impedance (that is, 75 ohms unbalanced, 135 ohms balanced, or 150 ohms balanced).

d. Arrange the test equipment as shown in figure 7-22 and adjust the test oscillator for an output level of 0 dBm at 60 kHz into the proper precision termination.

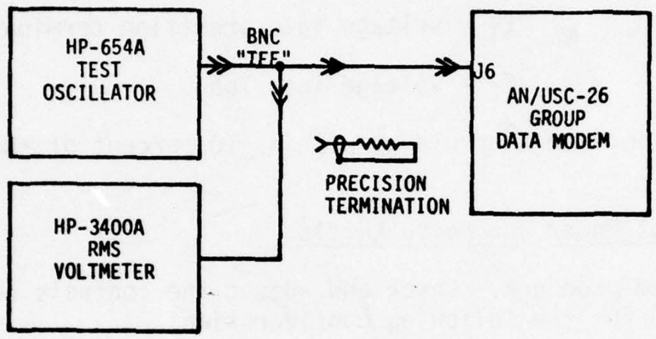


Figure 7-22. Transmit and Receive Group Input and Output Impedance.

e. Record the voltage level (E_1). Disconnect the standard termination and connect the output of the test oscillator to the transmit group output (J6) of the modem. Record the voltage level (E_2).

f. Repeat steps d and e at the following frequencies: 64, 68, 72, 74, 78, 82, 86, 90, 94, 98, 102, 106, and 108 kHz.

g. Disconnect the test equipment from the transmit group output and repeat steps d through f as applicable at the receive group input (J6).

h. Compute the impedance at each frequency as follows:

$$Z = \frac{E_2 R}{E_1}$$

where

Z = impedance

R = precision termination

E_1 = voltage into precision termination

E_2 = voltage into load.

i. The impedance should be within ± 10 percent of the rated value.

7.10.5 Output Power and Noise Levels.

a. Modem precheck. Check and adjust the controls on the AN/USC-26 for the following configuration:

(1) CONTROL MODE switch, NORMAL.

(2) POWER switch, ON

(3) FAULT VDC lamp, ON.

(4) FAULT TEMP lamp, OFF.

(5) Reset CONTROL MODE switch to TEST.

(6) Reset CONTROL FAULT switch to LAMP TEST. (NOTE: All indicators should light.)

(7) Reset CONTROL FAULT switch to OFF.

(8) Reset CONTROL MODE switch to NORMAL.

(9) Set the DATA RATE TRANSMIT switch to 50.0 kb/s.

(10) Press the CONTROL START switch.

b. Configure the test equipment as shown in figure 7-23 and allow for a 15-minute warmup and stabilization period.

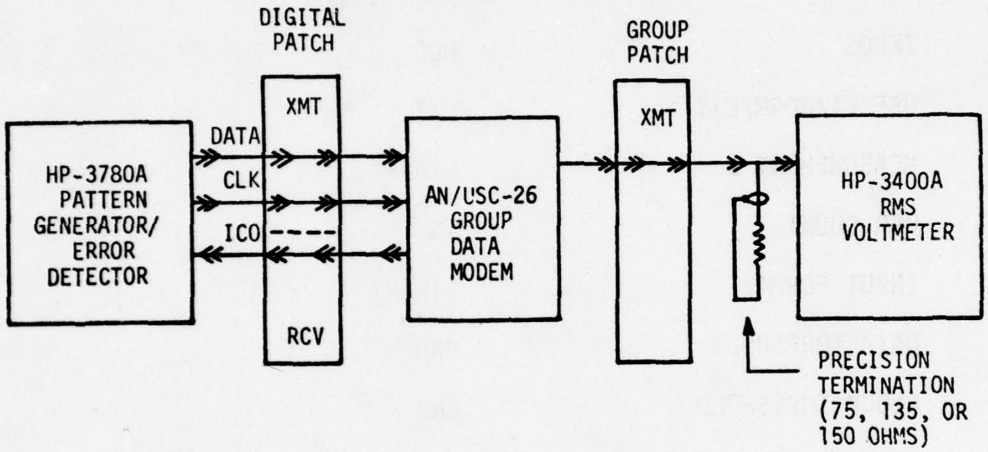


Figure 7-23. Group Data Modem Power Output and Noise Levels.

c. Set the controls on the HP-3780A pattern generator/ error detector as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZERO ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	000
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^8
INPUT FORMAT	BINARY
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

d. Initialize the modem. If all transmit indications are normal, record the voltmeter power output indication in dBm.

e. Disconnect the output of the HP-3780A and record the voltmeter noise indication in dBm.

f. The S/N in dB is equal to the difference between the signal level in dBm and the noise level in dBm; for example:

Signal level = -3 dBm

Noise level = -53 dBm

S/N = 50 dB.

7.10.6 Phase Jitter and Digital Signal-to-Noise.

a. Configure the test equipment as shown in figure 7-24 and allow for a 15-minute warmup and stabilization period.

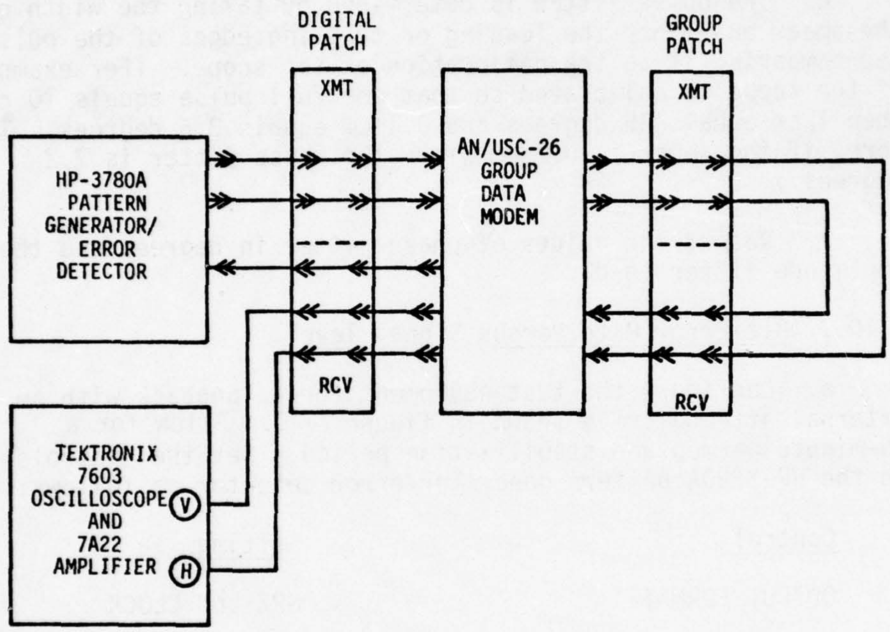


Figure 7-24. AN/USC-26 Phase Jitter and Digital S/N Measurement.

b. Adjust the oscilloscope to display one full pulse in 10 cm (360 degrees) on the horizontal axis and full-scale amplitude at 8 cm on the vertical axis (see figure 7-18).

c. Measure and record the amplitude jitter in V p-p and the phase jitter in degrees. The amplitude jitter will appear as a smear riding on the top of the pulse, while phase jitter will appear as a smear on the leading or trailing edge of the pulse.

d. Compute and record the dB equivalent of the amplitude jitter. The dB equivalent is derived by taking 20 log of the peak value of the smear divided by the peak value of the pulse:

Smear = 0.1 V p-p = 0.05 V peak

Pulse = 6 V p-p = 3 V peak

$$S/N \text{ (in dB)} = 20 \log \frac{0.05}{3.0} = 35.56 \text{ dB.}$$

e. The phase jitter is determined by taking the width of the smear on either the leading or trailing edges of the pulse and comparing it to the calibration of the scope. (For example, if the scope is calibrated so that one full pulse equals 10 cm, then 1 cm equals 36 degrees and 0.1 cm equals 3.6 degrees. Therefore, if the smear is 0.2 cm wide, the phase jitter is 7.2 degrees.)

f. Record the values of phase jitter in degrees and the amplitude jitter in dB.

7.10.7 Bit Error Rate Versus Signal level.

a. Configure the test equipment for a loopback with an external attenuator as shown in figure 7-25. Allow for a 15-minute warmup and stabilization period. Set the controls on the HP-3780A pattern generator/error detector as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZERO ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	009
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^6
INPUT FORMAT	BINARY
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

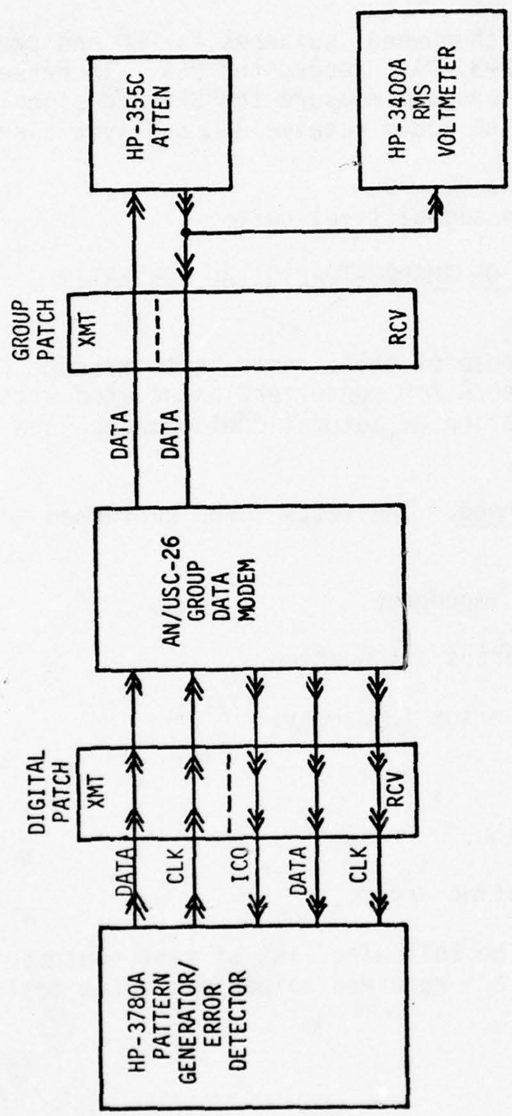


Figure 7-25. BER Versus Signal Level.

b. Adjust the external attenuator for 0 dB. Initialize the modem and wait for normal lockup.

c. Press the START button on the HP-3780A. The error count should be 0.9 x 10^{-5} (shown on the BER test set).

d. Adjust the ZEROS thumbwheel switches to 000 and press the START button on the HP-3780A. Record the BER. Increase the attenuation in 2-dB steps and measure the BER and signal level at each step until the modem receive AGC and sync alarms are noted on the modem.

e. Plot a BER versus signal level curve.

7.11 PERFORMANCE TESTING OF ANALOG-TO-DIGITAL CONVERTER CV-3034A/G.

7.11.1 Purpose. The purpose of these tests is to measure the performance of the CV-3034A/G A/D converters associated with the transmission and reception of automatic wideband secure voice communications.

7.11.2 Tests To Be Performed. The tests to be performed are as follows:

a. Input and output impedance.

b. Bit error rate versus attenuation.

c. Test tone level versus frequency.

d. Phase jitter.

e. Harmonic distortion.

f. Frequency translation error.

7.11.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	028
RMS voltmeter	HP-3400A	2	022
Precision termination, 600 ohms ±1% (BNC)		1	037
Precision termination, 135 ohms ±1% (BNC)		1	036
Precision termination, 75 ohms ±1% (BNC)		1	038
Variable step attenuator	HP-8494B	1	010
Balancing transformer, ohms (balanced) to 75 ohms (unbalanced)		2	048
Balancing transformer, 75 ohms (unbalanced) to 135 ohms (balanced)	HP-11474A	2	048
Pattern generator/error detector	HP-3780A	1	018
Frequency counter	HP-5340A	2	013
Balancing transformer, 600 ohms (balanced) to 135 ohms (balanced)		2	047
Phase jitter test set	HLI-48	1	026
Selective voltmeter	HP-312D	1	023
Distortion analyzer	HP-339A	1	004

7.11.4 Input and Output Impedance.

a. Configure the test equipment as shown in figure 7-26 and allow for a 15-minute warmup and stabilization period. Set the CV-3034 A/G input selector switch S2 to the HYBRID position.

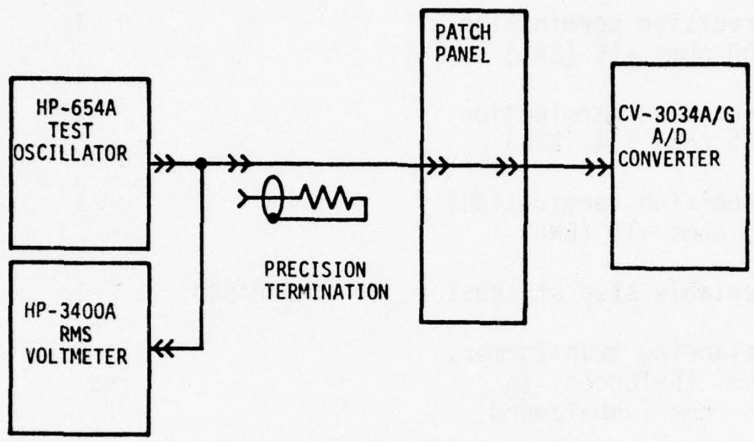


Figure 7-26. Input and Output Impedance Measurements.

b. Adjust the test oscillator for an ouput signal of 1000 Hz at 0 dBm and 135 ohms balanced into the 135-ohm precision termination. Record the voltage level from the rms voltmeter.

c. Disconnect the precision termination and connect the signal to the trasmit hybrid input of the CV-3034 A/G. Record the voltage level from the RMS voltmeter.

d. Compute the impedance as follows:

$$Z = \frac{E_2 R}{E_1}$$

where

Z = impedance in ohms

R = precision termination in ohms

E_1 = voltage into precision termination

E_2 = voltage into load.

(NOTE: This test assumes that the impedances to be measured are nonreactive. If the computed Z is greater than ±10 percent of the nominal value, further measurements should be made with a vector voltmeter or vector impedance meter to verify the computed values prior to making any repairs.)

e. Connect the signal to J9 on the CV-3034A/G and repeat steps b, c, and d at frequencies of 25 kHz and 50 kHz.

f. Adjust the test oscillator for an output signal of 1000 Hz at -10 dBm and 600 ohms balanced into the 600-ohm precision termination. Record the voltage level from the rms voltmeter.

g. Repeat steps c and d with the signal connected to the LOW LEVEL input (J1) on the CV-3034A/G and again with the signal connected to J10.

h. Configure the test equipment as shown in figure 7-26.

i. Adjust the test oscillator for an output signal of 25 kHz at -10 dBm and 75 ohms unbalanced into the 75-ohm precision termination. Record the voltage level from the rms voltmeter.

j. Disconnect the precision termination and connect the signal to J4 on the CV-3034A/G. Record the level from the rms voltmeter and compute the impedance as described in paragraph d above.

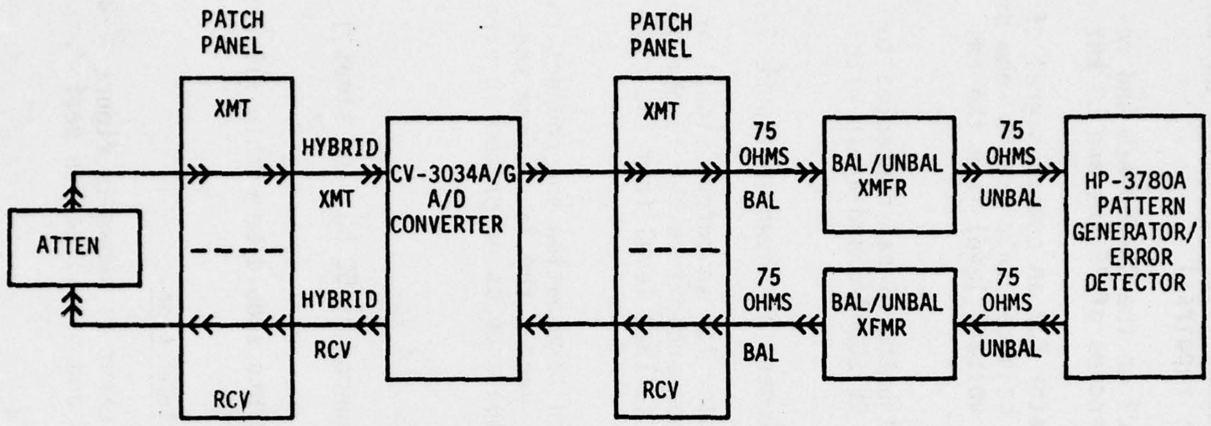
k. Repeat step j at J5, J7, and J8.

l. Repeat step i at a frequency of 50 kHz and steps j and k as described above.

m. The impedance at all points should be within ±10 percent of the rated value.

7.11.5 Bit Error Rate Versus Attenuation.

a. Configure the test equipment as shown in figure 7-27 and allow for a 15-minute warmup and stabilization period.



NOTE: THE BALANCING TRANSFORMERS MAY CAUSE TOO MUCH DISTORTION FOR PROPER OPERATION. IN THIS CASE, LINE TRANSCEIVERS MAY BE USED TO PROVIDE BALANCED TO UNBALANCED ISOLATION.

Figure 7-27. BER Versus Attenuation (User Side).

b. Set the controls on the HP-3780A test set as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZERO ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	009
OFFSET/NORM/EXT	EXT
BER COUNT	10^6
INPUT FORMAT	BINARY
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

c. Push the START button on the HP-3780A test set and record the results.

d. Increase the attenuator value in 2-dB steps and record the results at each step until a BER of 10^{-6} is reached or until the HP-3780A test set loses sync.

e. Plot a BER versus attenuation curve from the recorded data.

f. Configure the test equipment as shown in figure 7-28 and repeat steps b through e.

7.11.6 Test Tone Versus Frequency.

a. Configure the test equipment as shown in figure 7-29 and allow for a 15-minute warmup and stabilization period.

b. Adjust the test oscillator output for 1000 Hz at 0 dBm and 135 ohms balanced.

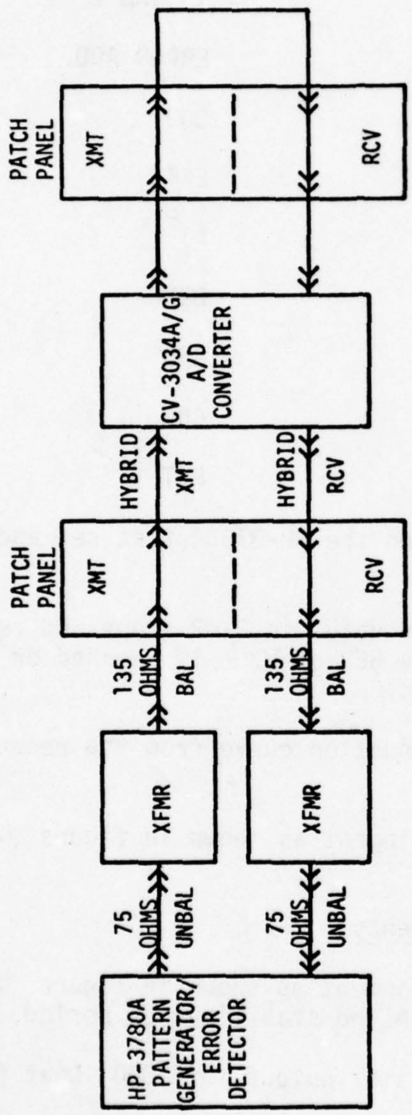


Figure 7-28. BER Versus Attenuation (Equipment Side).

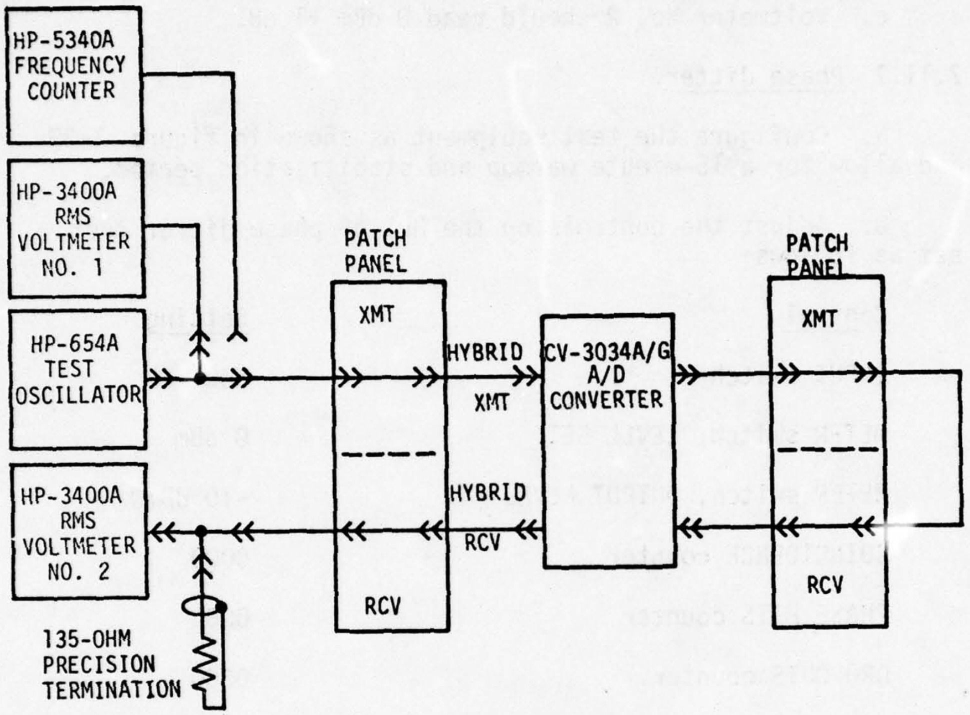


Figure 7-29. Test Tone Versus Frequency.

c. Voltmeter No. 2 should read 0 dBm ±1 dB.

d. Adjust the test oscillator output for 25 kHz at 0 dBm and 135 ohms balanced.

e. Voltmeter No. 2 should read 0 dBm ±1 dB.

7.11.7 Phase Jitter.

a. Configure the test equipment as shown in figure 7-30 and allow for a 15-minute warmup and stabilization period.

b. Adjust the controls on the HLI-48 phase jitter test set as follows:

Control	Setting
INPUT switch	600
METER switch, LEVEL SET	0 dBm
METER switch, OUTPUT LEVEL	-10 dBm0
COINCIDENCE counter	0000
PHASE HITS counter	0000
DROPOUTS counter	0000
AMPLITUDE HITS counter	0000
PEAK DEGREES selector	30°
ICS switch	3
METER switch, FREQUENCY (rcv freq)	1020 Hz
METER switch, VF (rcv level)	0 dBm ±1 dB
TIMER switch	15 minutes
COUNT/FLASH switch	COUNT
METER selector	30°
HIT DELAY adjustment	OUT

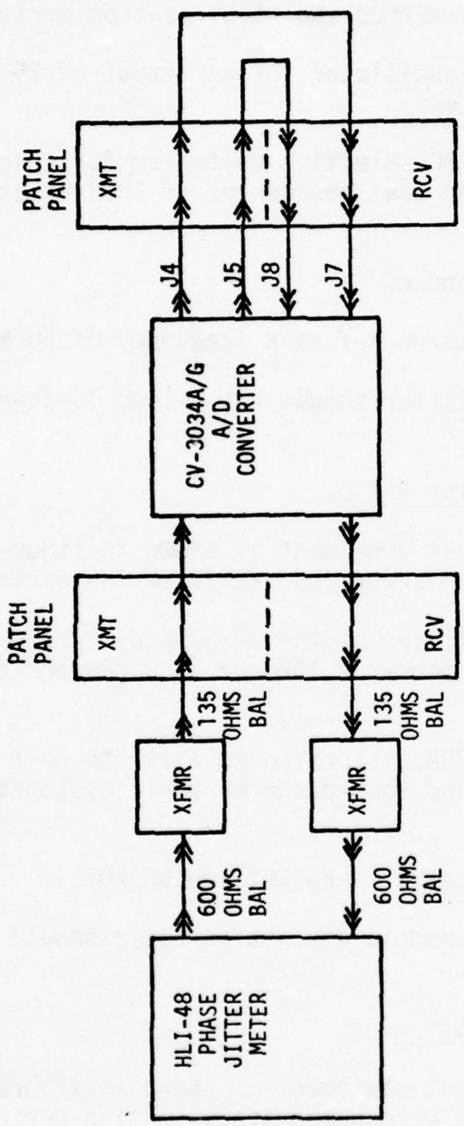


Figure 7-30. Phase Jitter Measurement (1020 Hz).

c. After the 15-minute timer period has elapsed, record the peak phase jitter, phase hits, dropouts, amplitude hits, and coincidental hits.

d. Configure the test equipment as shown in figure 7-31 and allow for a 15-minute warmup and stabilization period.

e. Adjust the test oscillator for an output of 25 kHz at 0 dBm and 135 ohms balanced.

f. Adjust the HP-312D selective voltmeter for a demodulated output (lower sideband beat frequency) of 1020 Hz at 0 dBm and 600 ohms balanced.

g. Repeat steps b and c.

h. Repeat steps b through f at a frequency of 50 kHz.

i. The peak phase jitter should not exceed 15 degrees at any frequency.

7.11.8 Harmonic Distortion Ratio.

a. Configure the test equipment as shown in figure 7-32 and allow for a 15-minute warmup and stabilization period.

b. Adjust the oscillator of the HP-339A distortion analyzer for an output frequency of 1020 Hz at 0 dBm and 600 ohms balanced.

c. Adjust the HP-339A distortion analyzer to null the 1020-Hz received signal and record the harmonic distortion level in dB.

d. Repeat steps b and c at 25 kHz and 50 kHz.

e. The signal-to-harmonic distortion ratio should exceed 40 dB at all frequencies.

7.11.9 Frequency Translation.

a. Configure the test equipment as shown in figure 7-33 and allow for a 15-minute warmup and stabilization period.

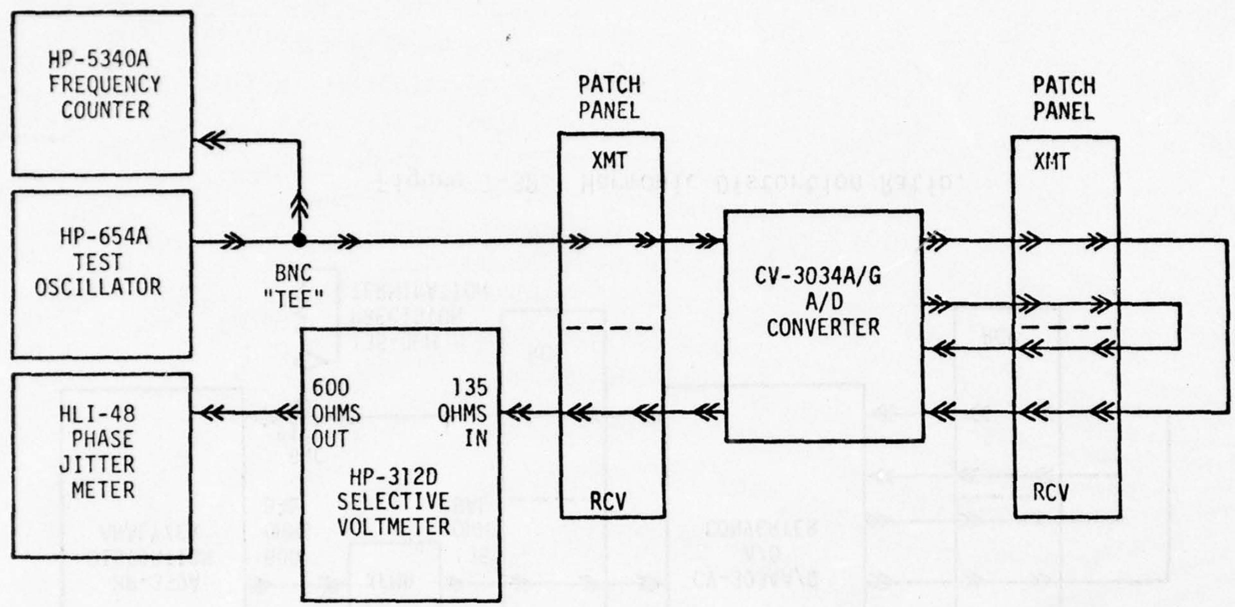


Figure 7-31. Phase Jitter Measurement (25 kHz and 50 kHz).

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STANDARD ENGINEERING INSTALLATION PACKAGE. WIDEBAND SECURE VOIC--ETC(U)

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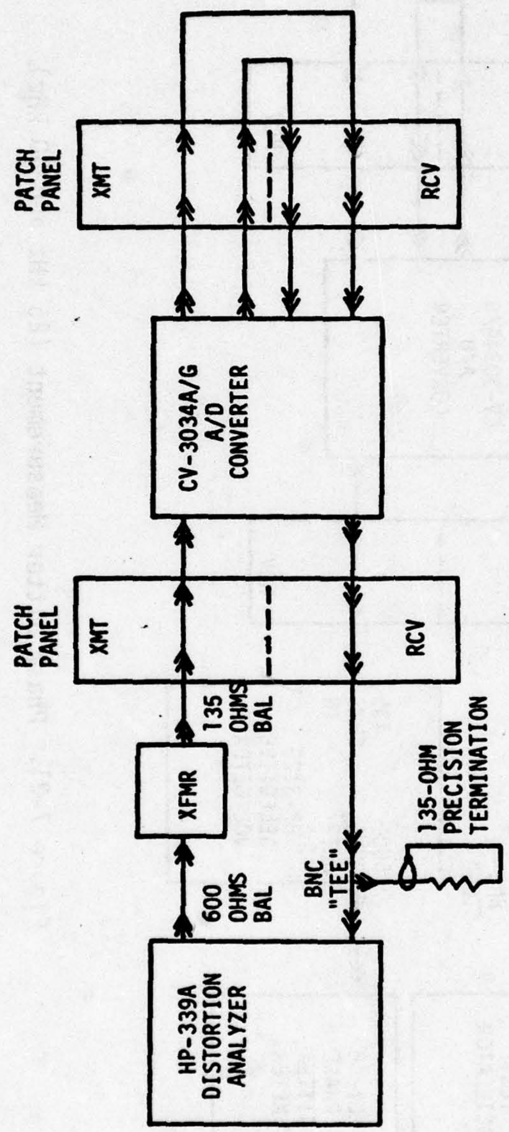


Figure 7-32. Harmonic Distortion Ratio.

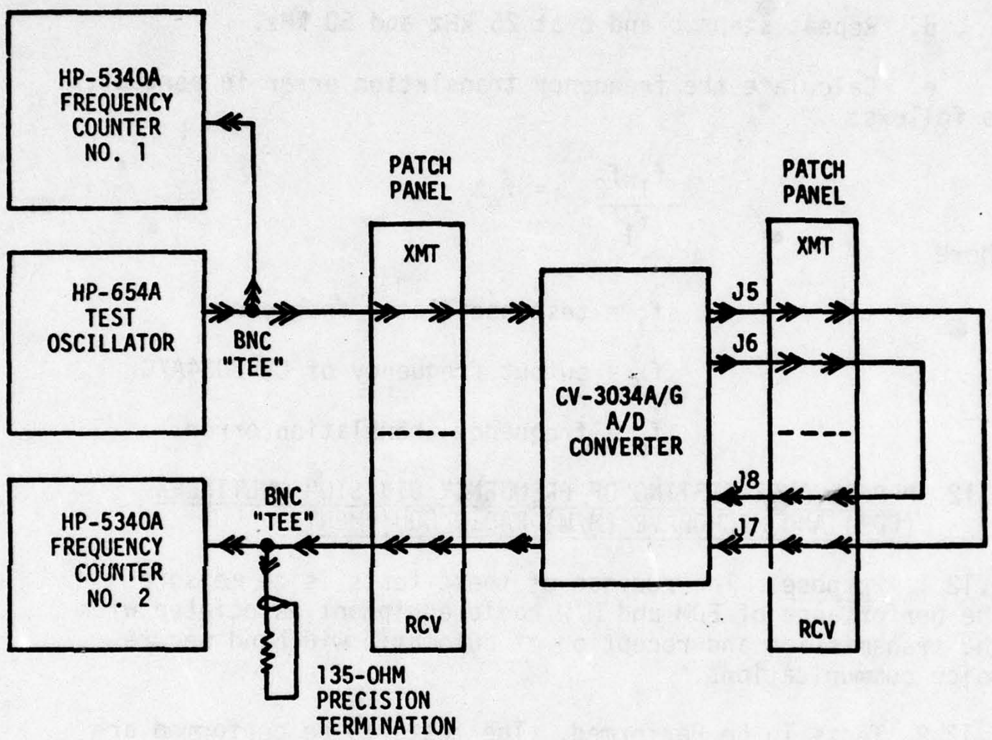


Figure 7-33. Frequency Translation Error.

b. Adjust the test oscillator for an output frequency of 1000 Hz at 0 dBm and 135 ohms balanced.

c. Record the frequency as shown on frequency counter No. 2.

d. Repeat steps b and c at 25 kHz and 50 kHz.

e. Calculate the frequency translation error in percent, as follows:

$$\frac{f_1 - f_2}{f_1} = f_e\%$$

where

f_1 = test oscillator frequency

f_2 = output frequency of CV-3034A/G

f_e = frequency translation error.

7.12 PERFORMANCE TESTING OF FREQUENCY DIVISION MULTIPLEX (FDM) AND MICROWAVE (M/W) RADIO EQUIPMENT.

7.12.1 Purpose. The purpose of these tests is to measure the performance of FDM and M/W radio equipment associated with the transmission and reception of automatic wideband secure voice communications.

7.12.2 Tests To Be Performed. The tests to be performed are as follows:

a. FDM group transmit and receive impedance.

b. FDM group frequency response.

c. FDM group idle noise.

d. FDM group noise power ratio (NPR) and basic intrinsic noise ratio (BINR).

e. FDM group phase jitter.

f. FDM group envelope delay distortion.

g. Basic group impulse noise.

7.12.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests.

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	027
RMS voltmeter	HP-3400A	2	022
Frequency counter	HP-5340A	1	013
Frequency selective voltmeter	HP-312D	1	023
Precision termination, 135 ohms ±1% (BNC)			036
White noise test set	Marconi OA-2090A	1	045
Balancing transformer, 75 ohms (unbalanced) to 135 ohms (balanced)	HP-11474A	2	048
Phase jitter test set	HLI-48	1	026
Envelope delay test set	Sierra 490B	1	042
Impulse noise counter	TTS-58A	1	014

7.12.4 FDM Group Transmit and Receive Impedance.

a. Configure the test equipment as shown in figure 7-34 following and allow for a 15-minute warmup and stabilization period.

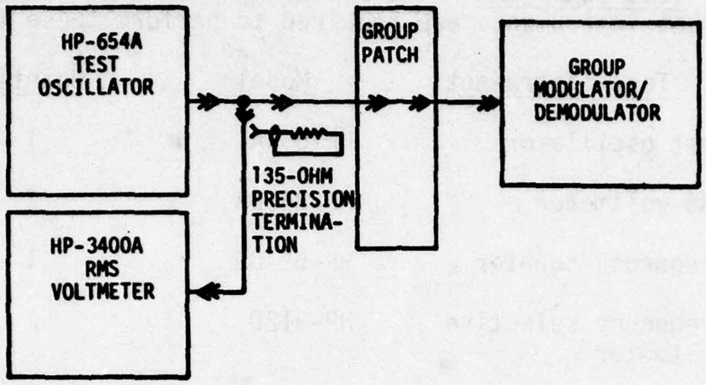


Figure 7-34. FDM Group Transmit and Receive Impedance.

b. Adjust the test oscillator for an output signal of 60 kHz at -10 dBm0 and 135 ohms balanced terminated into the 135-ohm precision termination.

(NOTE: In most cases (CCIR), the output or input impedance to the basic group modems is 135, 124, or 150 ohms balanced. Determine the nominal input and output impedance from manufacturers engineering specifications or other pertinent documents. An impedance matching transformer may be required for equipment with other than 135-ohm balanced inputs and outputs. A level of -10 dBm0 is equal to 10 dB below the nominal test tone level at the group input or output.)

c. Remove the precision termination and terminate the signal into the group input.

d. Record the voltmeter level.

e. Repeat steps b, c, and d at the following frequencies: 60, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 104, and 108 kHz.

f. Repeat steps b through e at the group output.

g. Calculate the group impedance at each of the frequencies as follows:

$$Z = \frac{E_2R}{E_1}$$

where

Z = impedance of group input or output

R = resistance of precision termination

E_1 = signal voltage into precision termination

E_2 = signal voltage into group input or output.

(NOTE: This test assumes that the input and output of the group modem are nonreactive. In cases where Z is more than ±10 percent of the nominal value, the impedance should be measured with a vector voltmeter or other device that measures impedance with reference to phase relationships prior to initiating any repairs.)

7.12.5 FDM Group Frequency Response.

a. At both the local and distant FDM terminal stations, configure the test equipment as shown in figure 7-35 and allow for a 15-minute warmup and stabilization period.

b. Deactivate the automatic group pilot level control, if used.

c. Adjust the test oscillators for output signals of 80 kHz at -10 dBm0 and 135 ohms.

d. At each station, check the baseband for the proper transmit and receive levels (for example, -10 dBm0 ±1 dB).

e. Adjust the test oscillators for output signals of 60 kHz at -10 dBm0 and 135 ohms.

f. Record the level as shown on the rms voltmeter.

g. Repeat steps e and f at the following frequencies: 60, 61, 62, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 104, 105, 106, 107, and 108 kHz.

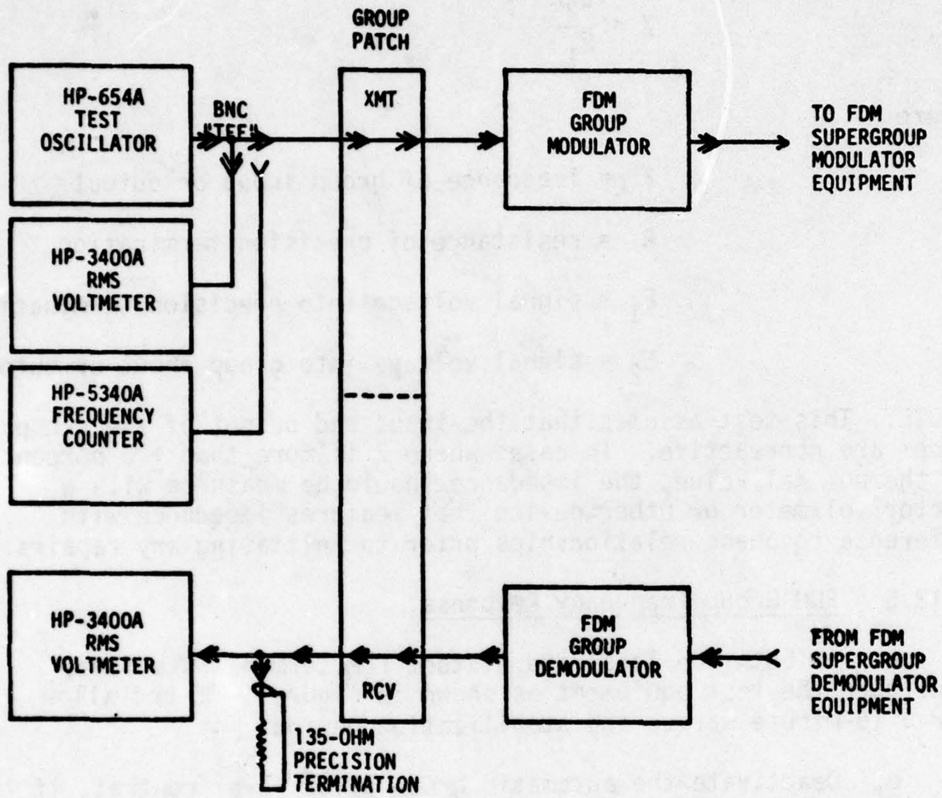


Figure 7-35. FDM Group Frequency Response.

h. At each station, plot frequency versus amplitude response curves for the group filters.

7.12.6 FDM Group Idle Noise.

a. Configure the test equipment as shown in figure 7-36 and allow for a 15-minute warmup and stabilization period.

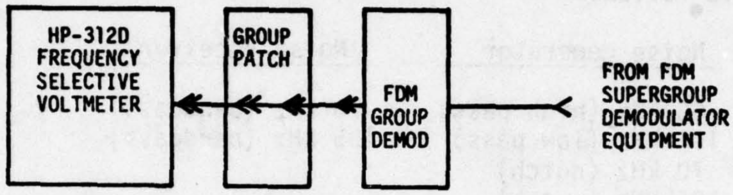


Figure 7-36. FDM Group Idle Noise.

b. Calibrate the HP-312D frequency selective voltmeter for a center frequency of 60 kHz and a meter range of -50 dBm0. Set the BANDWIDTH-Hz switch to 3100 and the RECEIVER MODE switch to LSB.

c. Instruct the distant FDM terminal to terminate the transmit group input with 135 ohms.

d. Using the HP-312D FREQUENCY TUNING COARSE control, slowly sweep the entire group passband from 60 to 108 kHz.

e. Record the frequency and amplitude of any noise greater than -49 dBm0. No noise levels greater than -39 dBm0 should be found.

7.12.7 FDM Group and M/W Radio NPR and BINR.

a. At both the local and distant FDM terminal stations, configure the test equipment as shown in figure 7-37 and allow for a 15-minute warmup and stabilization period.

b. This test should be performed during the heaviest traffic periods. The automatic group pilot level controls and group pilots should be deactivated.

c. Configure the noise test set filters for 12-channel operation as follows:

Noise generator	Noise receiver
60 kHz (high pass)	70 kHz (bandpass)
108 kHz (low pass)	105 kHz (bandpass)
70 kHz (notch)	
105 kHz (notch)	

d. Record the group test level point in dBm and, with the notch filters on, adjust the output of the generators to the calculated loading level for 12 channels. For CCIR systems, the loading level would be computed by (-1) + (4 log N) + (TLP), where N equals the number of channels and TLP is the test level point. DCA systems require (-10) + (10 log N) + (TLP).

e. Adjust the output of the noise generators until the proper loading level is indicated on the true rms voltmeters. The loading level for DCA systems is +0.8 dBm0; the loading level for CCIR systems is +3.3 dBm0. If the TLPs are -20 dBm, the meters would indicate -28.2 dBm for DCA systems and -25.7 dBm for CCIR systems. The 75- to 600-ohm meter mismatch has been considered in this calculation.

f. Record the receive levels at each station, which should be -8 or -3.3 dBm0, depending on the system design.

g. Adjust the noise receiver's 70- and 105-kHz oscillators in conjunction with the level control to give a reference indication. The attenuators should be set to 0 dB.

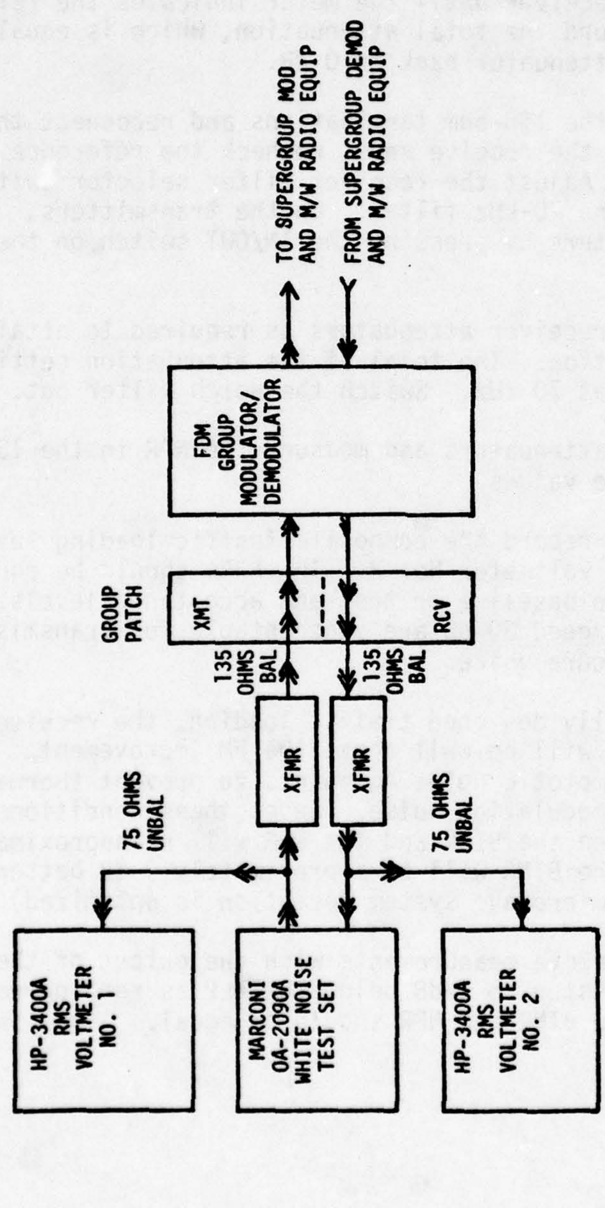


Figure 7-37. FDM Group and M/W Radio Noise Power Ratio (NPR) and Basic Intrinsic Noise Ratio (BINR).

h. Disconnect the noise generators and terminate the basic group modulator input with a 135-ohm termination. Adjust the attenuators on the receiver until the meter indicates the reference level and record the total attenuation, which is equal to the BINR. Set the attenuator back to 0 dB.

i. Disconnect the 135-ohm terminations and reconnect the noise generator. At the receive ends, recheck the reference level in each slot. Adjust the receiver filter selector switch to the position of the 70-kHz filter. On the transmitters, insert the notch filters by pressing the IN/OUT switch on the filter to IN.

j. Adjust the receiver attenuators as required to attain the reference indication. The total of the attenuation settings is equal to the NPR at 70 kHz. Switch the notch filter out.

k. Rezero the attenuators and measure the NPR in the 105-kHz slot. Record the values.

l. Measure and record the composite traffic loading level as shown on true rms voltmeter No. 2. The NPRs should be equal to or better than the baseline or test and acceptance levels. However, NPRs that exceed 30 dB are unacceptable for transmission of automatic secure voice.

m. Under normally designed traffic loading, the received signal levels (RSLs) will be well above the FM improvement threshold or the asymptotic quieting point, to prevent thermal masking of the intermodulation noise. Under these conditions, the separation between the BINR and the NPR will be approximately 3 dB (for example, the BINR will be approximately 3 dB better than the NPR if the microwave system deviation is optimized).

n. Repeat the above measurements with the output of the noise generators adjusted to 9 dB below the TLP as read on rms voltmeter No. 1. The BINR and NPR should be equal.

7.12.8 FDM Group Phase Jitter.

a. At both the local and distant FDM terminal stations, configure the test equipment as shown in figure 7-38 and allow for a 15-minute warmup and stabilization period.

b. Disable the automatic group pilot level controls (if used) and remove the group pilots.

c. Adjust the controls on the HLI-48 phase jitter meter as follows:

Control	Setting
COINCIDENCE counter	0000
DROPOUTS counter	0000
PHASE HITS counter	0000
AMPLITUDE HITS counter	0000
HIT DELAY adjustment	OUT
METER selector	30° (peak)
INPUT switch	600
PEAK DEGREES selector	15°
±dB switch	2
TIMER switch	0
FREQUENCY selector	84.08 kHz

d. Adjust the HP-654A test oscillator for an output signal of 84.08 kHz at -10 dBm0 and 135 ohms balanced.

e. Reset the phase jitter meter timer to 15 minutes and start the test.

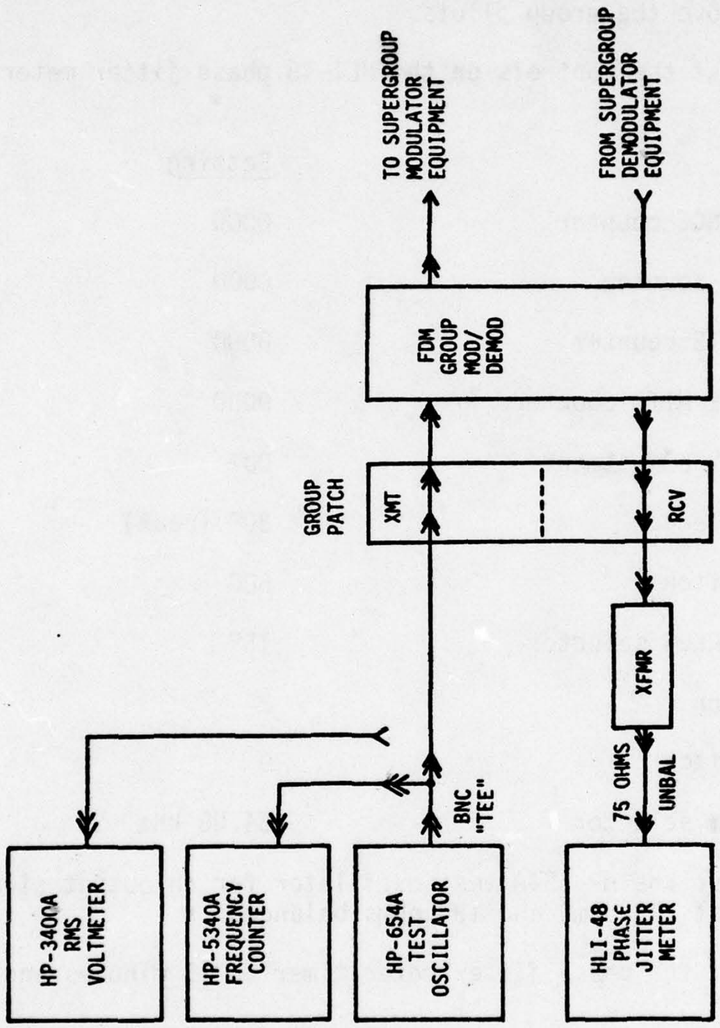


Figure 7-38. Phase Jitter.

f. Upon completion of the 15-minute timer period, record the amplitude hits, phase hits, coincidental phase hits, and instantaneous phase jitter. The phase jitter should not exceed 15 degrees in any 15-minute period.

g. If the multiplex system utilizes 84.08 or 104.08 kHz group pilot frequencies, enable the group pilots and repeat steps c through f.

7.12.9 <u>FDM Group Envelope Delay Distortion</u>.

a. At both the local and distant FDM terminal stations, configure the test equipment as shown in figure 7-39 and allow for a 15-minute warmup and stabilization period.

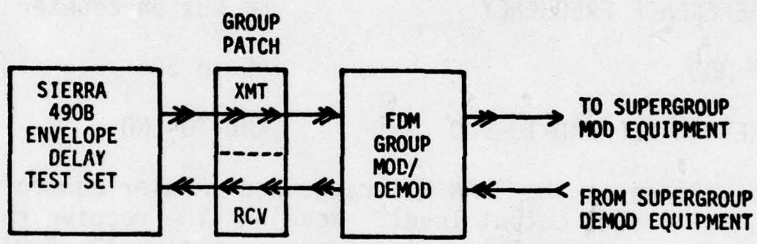


Figure 7-39. Envelope Delay Distortion.

b. Calibrate the Sierra 490B envelope delay test set according to the manufacturer's instruction manual.

c. Adjust the envelope delay test set controls as follows:

Control	Setting
TRANSMIT IMPEDANCE	130/135
SWEEP/CARRIER/REFERENCE	CARRIER
FREQUENCY	kHz
RANGE switch	50 - 600

Control	Setting
SWEEP CALIBRATE	LOW CAL
TRANSMIT/RECEIVE FREQUENCY	TRANSMIT
RECEIVE IMPEDANCE	130/135
TRANSMIT LEVEL (range)	-20 dBm
TRANSMIT LEVEL (vernier)	-10 dBm
RECEIVE LEVEL (range)	-10 dB below receive TLP
CARRIER FREQUENCY	84 kHz on counter
REFERENCE FREQUENCY	84 kHz on counter
% MOD	45 to 50%
RETURN REF/END-TO-END	END-TO-END

d. Readjust the TRANSMIT range and vernier controls to obtain a -13 dBm0 output level. Readjust the receive range control for an on-scale reading (approximately -13 dBm0).

e. Adjust the delay meter range switches and the zero adjust controls to attain a reference delay of 2 milliseconds or any suitable value above 1 millisecond.

f. Measure the receive frequency by setting the TRANSMIT/RECEIVE frequency switch to RECEIVE and observe the counter, which should read 84 kHz. Reset the switch to TRANSMIT.

g. Press the sync button momentarily and release it. The delay reading should deviate abruptly and return to the reference delay indication.

h. At this point, the link is set up to measure the delay distortion relative to a carrier and reference frequency of 84 kHz at a relative delay of 2 milliseconds in the end-to-end mode.

i. At each station, adjust the transmit carrier frequency control to attain the following listed test frequencies and record the delay readings: 60, 64, 68, 72, 76, 80, 84 (reference), 88, 92, 96, 100, 104, and 108 kHz.

j. Anlayze the delay measurements in relation to the ref-ference delay at 84 kHz. The relative delay across the entire 60- to 108-kHz frequency passband should not exceed the following values:

Radio path length		Envelope delay (μs)
Km	Miles	
0-100	0-62.5	-9.0 to +3.2
100-201	62.5-125	-9.4 to +5.8
201-402	125-250	-9.7 to +8.0
402-804	250-500	-9.9 to +8.5
804-1609	500-1000	-0.1 to +0.5
1609-3218	1000-2000	-10.7 to +3.6
3218-6436	2000-4000	-10.9 to +4.9

7.12.10 FDM Group Impulse Noise Measurement.

a. At both the local and distant FDM terminal stations, configure the test equipment as shown in fiqure 7-40 and allow for a 15-minute warmup and stabilization period.

b. Adjust the test oscillators for an output signal of 84 kHz at -13 dBm0 and 135 ohms balanced.

c. Adjust the frequency selective voltmeters for a beat frequency output of 1 kHz at 0 dBm and 600 ohms balanced.

d. Adjust the impulse noise counter controls as follows:

Control	Setting
HIGH	16 dBrn
MID	6 dBrn
LOW	0 dBrn
INPUT REF LEVEL	70 dBrn
INPUT	600
BRDG/TERM	TERM
HOLD	ON
WTG	FLAT

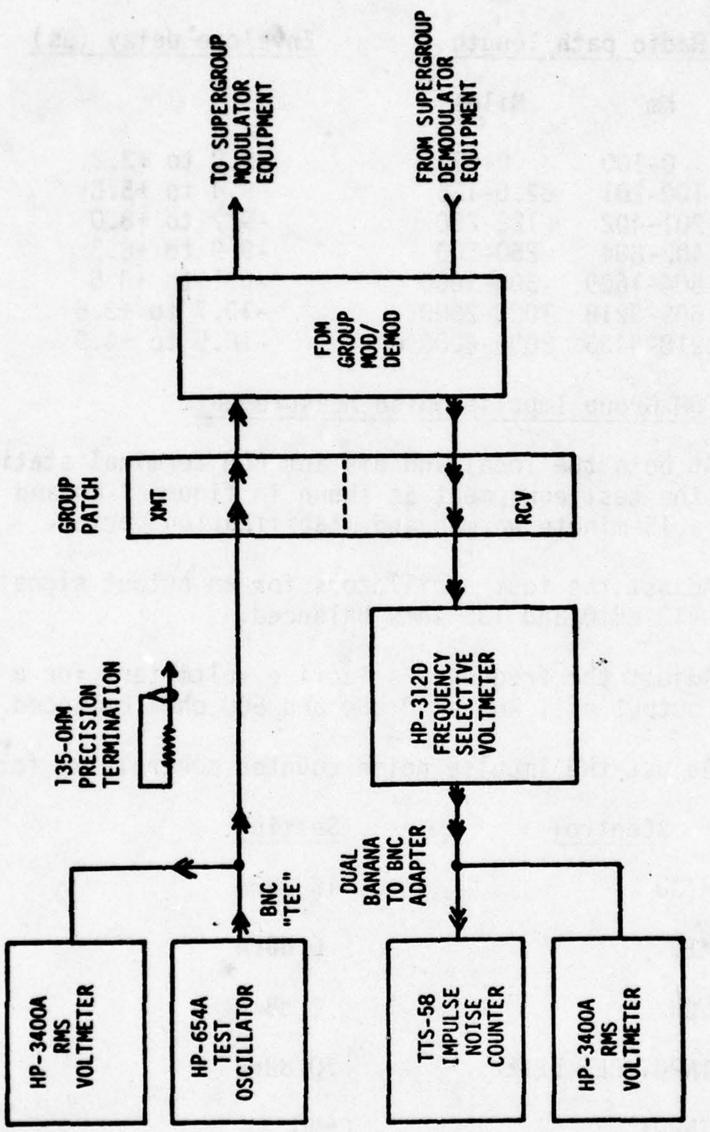


Figure 7-40. Impulse Noise Measurement.

e. Remove the test oscillator signals and terminate the group transmit input at each station with 135-ohm precision terminations.

f. Zero out the impulse counters and set the timer for 15 minutes.

g. After the 15-minute test period has elapsed, record the counter settings. The impulse noise counts should not exceed 175 counts in 15 minutes above the midlevel reference, which is -10 dBm0. (NOTE: Generally, the impulse counts are less than 15 counts in 15 minutes above a reference level of 72 dBrnC0 or 71 dBrn0.)

7.13 PERFORMANCE TESTING OF METALLIC CABLE PAIRS.

7.13.1 Purpose. The purpose of these tests is to test the performance of metallic cable pairs interconnecting KY-3 subscribers with KY-3 subscribers, KY-3 subscribers with SECORD switchboards, and SECORD switchboards with SECORD switchboards.

7.13.2 Tests To Be Performed. The tests to be performed are as follows:

a. Cable pair phase jitter.

b. Low frequency signal-to-noise ratio.

c. Wideband signal-to-noise ratio.

d. Impulse noise.

e. Net loss variation.

f. Line-up loss.

g. Envelope delay distortion.

h. Nominal data levels.

i. Bit error rate.

j. Minimum longitudinal balance.

7.13.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	2	027
Phase jitter test set	HLI-48	1	026
Frequency selective voltmeter	HP-312D	1	023
Spectrum analyzer	HP-3580A	1	006
RMS voltmeter	HP-3400A	2	022
Impulse noise counter	TTS-58	1	014
Precision termination, 600 ohms ±1% (BNC)		2	037
Precision termination, 135 ohms ±1% (BNC)		2	
Oscillographic recorder	HP-7702B	1	035
Recorder preamplifier	HP-8801A	2	003
Envelope delay test set	Sierra 490B	2	042
Oscilloscope	Tektronix 7603	1	029
Oscilloscope amplifier	Tektronix 7A22	2	007
75-ohm unbalanced to 600-ohm balanced line transceiver		4	051
Pattern generator/ error detector	HP-3780A	2	018

7.13.4 Voltage Precheck. Prior to performing any tests, the cable pairs to be tested must be checked with a multimeter or oscilloscope to determine whether dangerous or damaging voltage levels are present.

7.13.5 Cable Pair Phase Jitter.

a. At both ends of the cable pair, configure the test equipment as shown in figure 7-41 and allow for a 15-minute warmup and stabilization period.

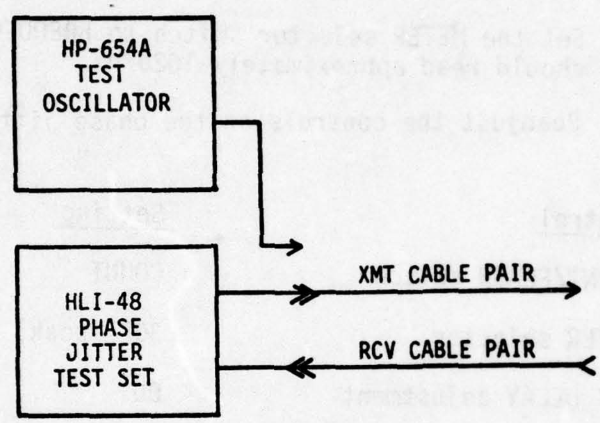


Figure 7-41.. Cable Pair Phase Jitter (Low Frequency).

b. Adjust the controls on the HLI-48 phase jitter test sets as follows:

Control	Setting
INPUT switch	600
METER switch, LEVEL SET	0 dBm
METER switch, OUTPUT LEVEL	-10 dBm0
COINCIDENCE counter	0000
PHASE HITS counter	0000
DROPOUTS counter	0000
AMPLITUDE HITS counter	0000

Control	Setting
PEAK DEGREES selector	30°
±dB switch	3
METER selector	RECEIVE LEVEL
FREQUENCY selector	VF

c. The receive level should be -10 dBm0 ±1 dB.

d. Set the METER selector switch to FREQUENCY. The frequency meter should read approximately 1020 Hz.

e. Readjust the controls on the phase jitter test sets as follows:

Control	Setting
COUNT/FLASH switch	COUNT
METER selector	30° (peak)
HIT DELAY adjustment	OUT
TIMER switch	30 minutes

f. Record the readings at the end of the 30-minute measurement period.

g. Disconnect the transmit portions of the phase jitter test sets and connect the test oscillators to the transmit cable pairs.

h. Adjust the HP-654A test oscillator for an output signal of 1000 Hz at -10 dBm0 and 135 ohms balanced.

i. Set the INPUT switch on the phase jitter test set to 135 ohms. Zero out the counters and reset the TIMER switch for 30 minutes.

j. Record the readings at the end of the 30-minute measurement period.

k. At both ends of the cable pair, configure the test equipment as shown in figure 7-42 and allow for a 15-minute warmup and stabilization period.

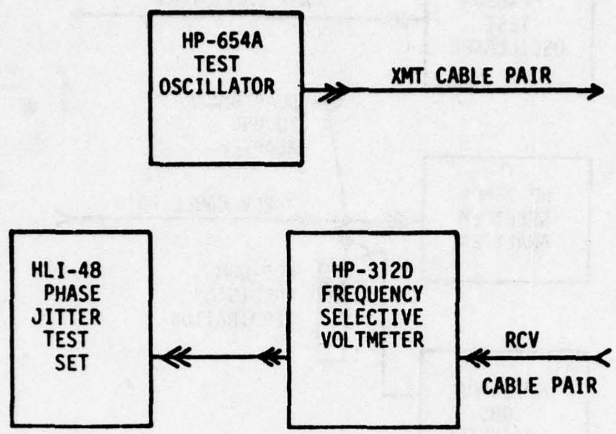


Figure 7-42. Cable Pair Phase Jitter (High Frequency).

l. Adjust the test oscillator for an output signal of 25 kHz at -10 dBm0 and 135 ohms balanced.

m. Adjust the HP-312D frequency selective voltmeter for a frequency of 26 kHz and a bandwidth of 3100 Hz. Adjust the RANGE-dB switch for a convenient meter display and the RECEIVER MODE switch to BEAT.

n. Set the AUDIO AMPLITUDE control for a -10 dBm0 output and connect the phase jitter input to the HP-312D 310 PLUG output.

o. Set the INPUT switch on the phase jitter meter to 600 ohms, zero out the counters, and reset the TIMER switch for 30 minutes.

p. Record the readings at the end of the 30-minute measurement period.

q. Repeat steps l through p at 50 kHz.

r. Phase jitter should not exceed 15 degrees p-p at any frequency tested.

7.13.6 Low Frequency Signal-to-Noise Ratio.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-43 and allow for a 15-minute warmup and stabilization period.

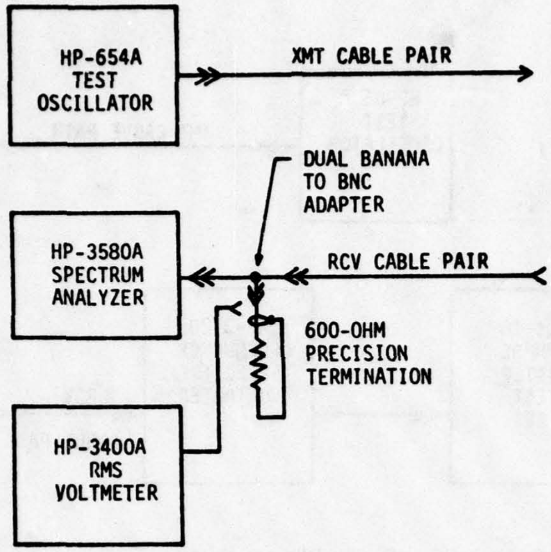


Figure 7-43. Low Frequency S/N Ratio.

b. Adjust the HP-654A test oscillator for an output signal of 50 Hz at 0 dBm0 and 600 ohms balanced.

c. Adjust the HP-3580A spectrum analyzer controls as follows:

Control	Setting
FREQUENCY selector	00.25 kHz
RESOLUTION BANDWIDTH switch	50 Hz
FREQ SPAN/DIV. switch	50 Hz
SWEEP TIME/DIV. switch	.2 SEC
SWEEP MODE switch	REP
DISPLAY pushbuttons	CLEAR WRITE
AMPLITUDE MODE pushbuttons	10 dB
dBv/LIN - dBm 600Ω switch	dBm 600Ω
INPUT SENSITIVITY	Set for noise floor at ≈ -80 dB
AMPLITUDE REF LEVEL	Set to display received signal at 0 dB

d. Record the amplitude of the 50-Hz signal from the rms voltmeter and note the amplitude of the signal as shown on the spectrum analyzer display.

e. Remove the test signal from the transmit end of the cable pair and terminate the pair with the 600-ohm termination.

f. Note the amplitude of the remaining noise signals on the spectrum analyzer display and compute the S/N ratio as the difference between the tone ON and tone OFF levels in dB as follows:

$$S/N\ (dB) = A_1 - A_2$$

where

A_1 = amplitude of tone in dB (from spectrum analyzer display)

A_2 = amplitude of noise with tone in dB (from spectrum analyzer display).

g. Repeat steps b through f at the following frequencies: 60, 120, 240, and 360 Hz.

7.13.7 <u>Wideband Signal-to-Noise Ratio</u>.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-44 and allow for a 15-minute warmup and stabilization period.

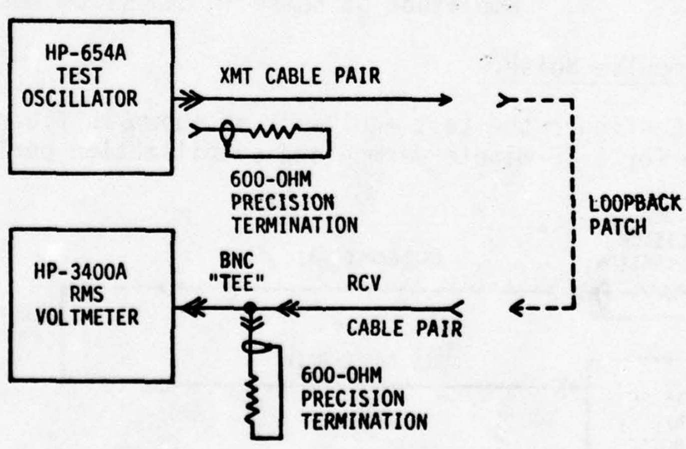


Figure 7-44. Wideband S/N Ratio.

b. Adjust the HP-654A test oscillator for an output signal of 1200 Hz at 0 dBm0 and 600 ohms balanced.

c. Record the output level as shown on the rms voltmeter.

d. Repeat steps b and c at frequencies of 25 and 50 kHz.

e. Remove the test oscillator and terminate the cable pair with a 600-ohm termination.

f. Record the noise level as shown on the rms voltmeter.

g. Repeat steps b through f with the test oscillator set for 135 ohms balanced and using a 135-ohm termination.

h. At the subscriber end of the cable, configure the cable pairs for a loopback.

i. Repeat steps b through g with the cable pairs looped back.

j. Compute the S/N ratio at each frequency and impedance as follows:

$$S/N\ (dB) = A_1 - A_2$$

where

A_1 = amplitude of tone in dBm (from rms voltmeter)

A_2 = amplitude of noise in dBm (from rms voltmeter).

7.13.8 *Impulse Noise.*

a. Configure the test equipment as shown in figure 7-45 and allow for a 15-minute warmup and stabilization period.

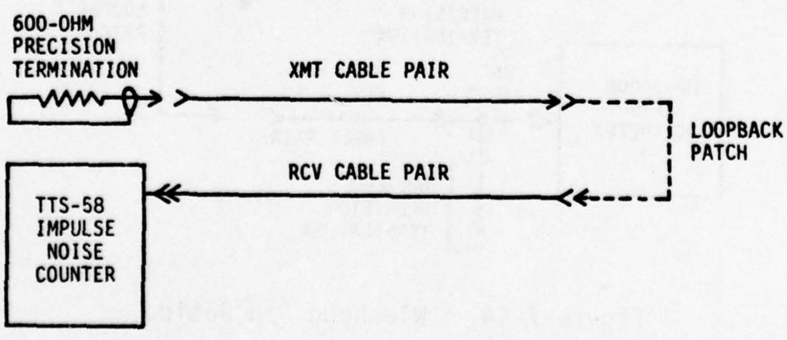


Figure 7-45. Impulse Noise Measurement.

b. Adjust the controls on the TTS-58 impulse noise counter as follows:

Counter	Setting
WEIGHTING switch	FLAT
INPUT switch	600 ohms
BRDG/TERM switch	TERM
HOLD switch	ON
HIGH RANGE counter	0000
MIDRANGE counter	0000
LOW RANGE counter	0000

c. Set the MIDRANGE threshold control to the level recorded in paragraph 7.13.7f (wideband signal-to-noise ratio).

d. Set the HIGH RANGE threshold control to 3 dB above the MIDRANGE setting and the LOW RANGE threshold control to 3 dB below the MIDRANGE setting.

e. Terminate the transmit end of the cable pair with a 600-ohm termination and set the impulse counter timer for 15 minutes.

f. After the 15-minute measurement period, record the impulse counts.

g. Set the WEIGHTING switch on the impulse noise counter to the 10.2 KC - 51 KC position and the INPUT control to 135 ohms.

h. Set the MIDRANGE threshold control to the level recorded in paragraph 7.13.7g.

i. Repeat steps d, e, and f using a 135-ohm termination.

j. At the subscriber end of the cable, configure the cable pairs for a loopback.

k. Set the MIDRANGE threshold control to the level recorded in paragraph 7.13.7i.

l. Repeat steps d, e, and f.

7.13.9 Net Loss Variation.

a. Configure the test equipment as shown in figure 7-46 and allow for a 15-minute warmup and stabilization period.

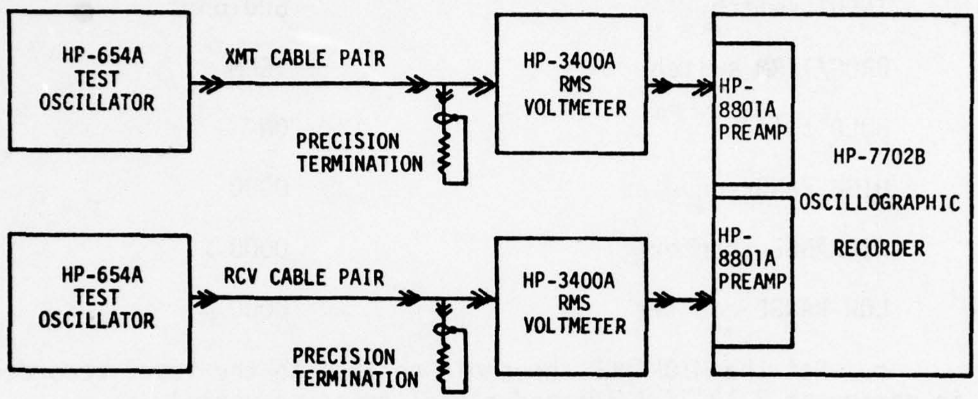


Figure 7-46. Net Loss Variation.

b. Adjust the HP-654A test oscillators for an output signal of 1000 Hz at 0 to -10 dBm0 and 600 ohms balanced. (NOTE: The test oscillators should be adjusted so that the rms voltmeters indicate 0.5 on the voltage scale within 0 and -10 dBm0. In other words, if the nominal test tone level is -16 dBm, then -16 dBm = 0 dBm0 and the signal for this test should be adjusted to indicate 0.05 volt or -7.7 dBm0 on the rms voltmeter. This is done to allow for a full-scale meter deflection of the rms voltmeter.)

c. Adjust the controls on the HP-7702B oscillographic recorder as follow:

Control	Setting
POWER switch	ON
CHART SPEED	20 mm/minute
MARKER	1 minute

d. With the dc output from the rms voltmeters disconnected, calibrate the HP-8801A preamplifiers as follows:

(1) Set the CAL & ZERO SUPP VOLTS switch to the OFF position.

(2) Set the signal USE button to the IN position; that is, button should extend about 1/4 inch.

(3) Set the POS (position) control for zero output (chart center).

(4) Rotate the GAIN control throughout its full range. There should be no change in output, which indicates that the preamplifier is balanced.

(5) If an output change occurs, adjust the BAL control for no change in the output as the GAIN control is turned.

(6) Set the RANGE V/DIV switch to .005.

(7) Set the POS control for zero output (chart center).

(8) Set the CAL & ZERO SUPP switch to CAL.

(9) Adjust the GAIN control for a 20-division stylus deflection (2-V output) in response to the CAL signal.

(10) Set the CAL & ZERO SUPP switch to OFF.

(11) Set the signal USE switch to OFF (extended approximately 3/8 inch).

(12) Set the POS control to center the stylus on the chart.

(13) Set the CAL & ZERO SUPP switch to -10.

(14) Connect the outputs of the rms voltmeters to the inputs of the oscillographic recorder.

(15) Set the signal USE-OFF switch to the USE position.

(16) Apply the input signals from the rms voltmeters and advance the RANGE switch for a convenient deflection (.02).

(17) Suppress the dc signal voltage component using the ZERO SUPP control, and advance the RANGE V/DIV control for

an increased amplification of the signal components remaining while fine tuning the zero suppression.

(18) Set the RANGE V/DIV control to .02.

(19) Slowly adjust the test oscillator amplitude controls for indications on the rms voltmeters of -10 dB to +2 dB and note the stylus deflection on the oscillograph. The stylus should deflect from approximately 0.24 (-10 dB) to approximately 0.96 (+2 dB) on the paper.

e. Run the test for 8 hours.

f. Repeat steps b through d with the oscillators adjusted for 25 kHz and 135 ohms. Change the rms voltmeter terminations to 135 ohms.

g. Run the test for 30 minutes.

h. Reduce the data into 15-minute periods, which shows the maximum deflections indicated on the oscillograph paper between 0 and 1.0.

i. Record the maximum net loss variation in dB for each 15-minute period using the scales on the rms voltmeters. A deflection of 0.5 on the oscillograph equals 0.5 on the voltmeter scale. A deflection of 0.5 on the voltmeter scale (which is equal to approximately 3.9 on the dB scale) was previously calibrated to be the 0-dB reference point.

Example: If the oscillograph deflection is 0.35, then locate the 0.35-V point on the voltmeter scale and note the equivalent point on the decibel scale (approximately -6.7). Subtract -3.9 from -6.7. The net loss negative variation is -2.8 dB.

7.13.10 Line-Up Loss.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-47 and allow for a 15-minute warmup and stabilization period.

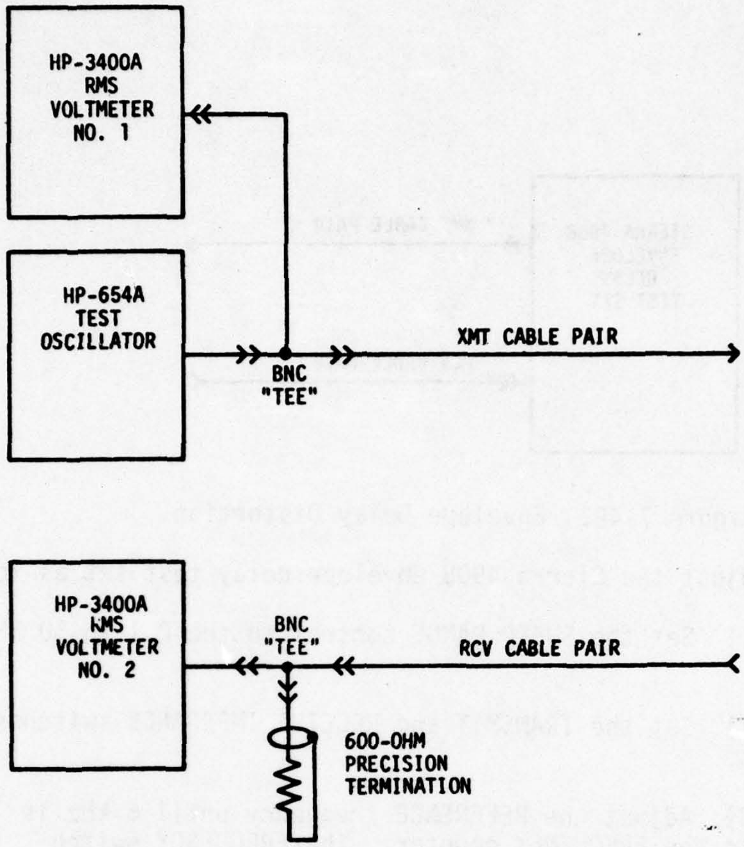


Figure 7-47. Line-Up Loss.

b. Adjust the HP-654A test oscillator for an output signal of 100 Hz at -10 dBm0 and 600 ohms balanced.

c. Record the received level as indicated on rms voltmeter No. 2.

d. Repeat steps b and c at the following frequencies: 1, 3, 5.5, 10, 18, 25, 32, and 50 kHz.

e. Repeat steps b, c, and d with the test oscillator adjusted for a 135-ohm balanced output and a 135-ohm precision termination at rms voltmeter No. 2.

7.13.11 <u>Envelope Delay Distortion</u>.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-48 and allow for a 30-minute warmup and stabilization period.

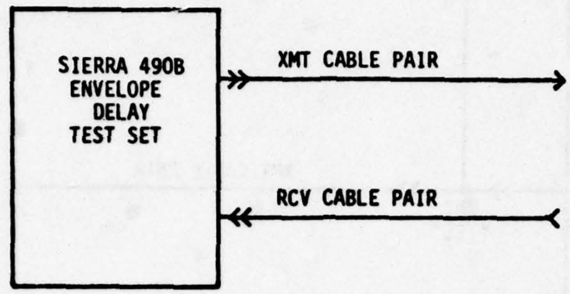


Figure 7-48. Envelope Delay Distortion.

b. Adjust the Sierra 490B envelope delay test set as follows:

(1) Set the SWEEP RANGE control to the 0.1 to 50 kHz position.

(2) Set the TRANSMIT and RECEIVE IMPEDANCE switches to 600 ohms.

(3) Adjust the REFERENCE frequency until 6 kHz is indicated on the FREQUENCY counter. The FREQUENCY switch should be in the kHz position.

(4) Adjust the SWEEP/CARRIER/REFERENCE switch to CARRIER and the CARRIER FREQUENCY control to 6 kHz.

(5) Adjust the TRANSMIT COARSE and VERNIER OUTPUT power controls until -10 dbm0 is indicated on the POWER meter. NOTE: The 0/0 MOD/RECEIVE LEVEL/TRANSMIT LEVEL switch should be in the TRANSMIT LEVEL position.

(6) Connect a suitable coaxial cable between the TRANSMIT OUTPUT plugs and RECEIVE INPUT plugs and adjust the 0/0 MOD/RECEIVE LEVEL/TRANSMIT LEVEL.

(7) Adjust the RECEIVE LEVEL COARSE and VERNIER switches as required to attain a -10 dbm0 indication on the POWER meter.

(8) Set the MODULATION FREQUENCY switch to 83.33 Hz, the RETURN REF/END-TO-END SWITCH to END-TO-END, and 0/0 MOD/RECEIVE LEVEL/TRANSMIT LEVEL switch to 0/0 MOD.

(9) Adjust the 0/0 MOD control until the meter reads between 46 and 50 on the 0/0 MOD scale.

(10) Adjust the following listed switches as required to attain a relative delay at 6 kHz (normally 1,000 μs):

(a) FINE and COARSE delay M5 switches.

(b) The delay METER RANGE (.15 to 15 or 310) and the ZERO ADJ switches.

(11) Once the relative delay has been established, push and release the SYNC button. If the delay returns to the reference setting, the equipment is normal and the test can proceed.

c. Connect the TRANSMIT OUTPUT of the delay test set to the TRANSMIT cable pair and the INPUT to the RECEIVE cable pair.

d. Adjust the END-TO-END/RETURN REF switch to END-TO-END at location A and to RETURN REF at location B.

e. At location A, adjust the ZERO ADJ control until a "?" is indicated on the delay meter.

f. If all indications are normal, adjust the CARRIER FREQUENCY control to the following listed frequencies and record the delay readings:

Frequency in kHz

4	14	24	34	44
6	16	26	36	46
8	18	28	38	48
10	20	30	40	50
12	22	32	42	52

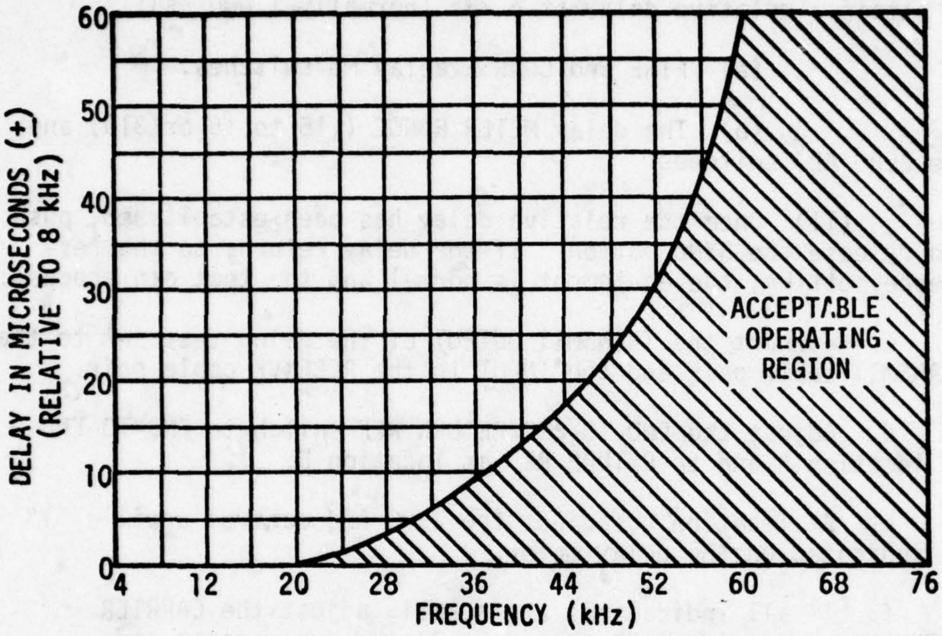
g. The delay at 6 kHz should be checked periodically for instrumentation drift or instability.

h. Adjust the END-TO-END/RETURN REF switch to the END-TO-END position at location B and to the RETURN REF position at location A.

i. At location B, set the ZERO ADJ control until a "?" is indicated on the delay meter.

j. Repeat step f.

k. The envelope delay distortion should be within the limits shown in figure 7-49.



NOTES:

1. The above curve represents envelope delay requirements. Limits are not specified below 6 kHz.

2. If the entire circuit consists of equalized twisted-pair cable from which all loading coils and bridge taps have been removed, no delay equalization should be required.

3. Should the circuit contain carrier facilities, delay equalization must be employed so that the delay versus frequency response of the circuit is a smoothly and continuously increasing function of frequency, which falls within the shaded area of this figure.

Figure 7-49. Envelope Delay Parameters.

7.13.12 Nominal Data Levels.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-50 and allow for a 15-minute warmup and stabilization period.

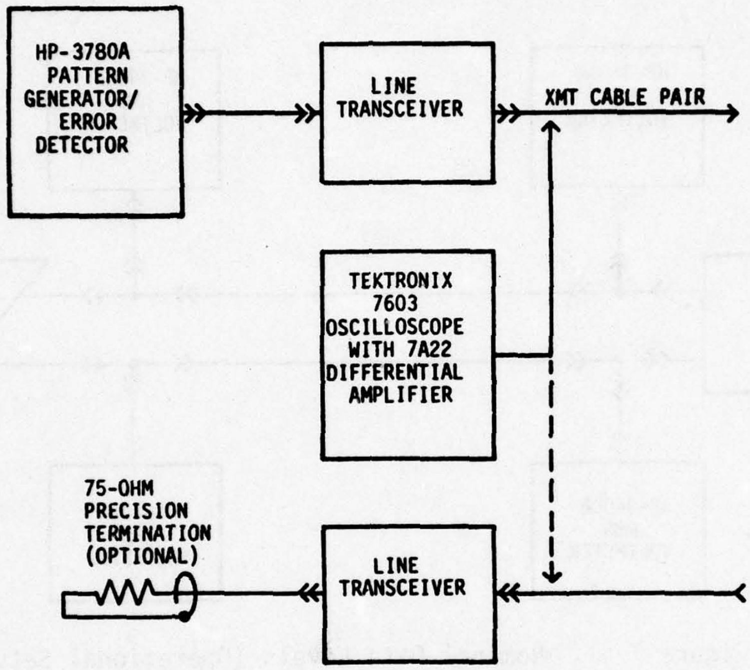


Figure 7-50. Nominal Data Levels (Using Test Setup).

b. Configure the line transceivers for a line impedance of 600 ohms.

c. Configure the HP-3780A pattern generator for 50-kb/s, pseudorandom output.

d. Measure the signal level at both the transmit and receive end in volts p-p using the oscilloscopes.

e. Configure the line transceivers for a line impedance of 135 ohms and repeat steps c and d.

f. Configure the test equipment as shown in figure 7-51 and allow for a 15-minute warmup and stabilization period.

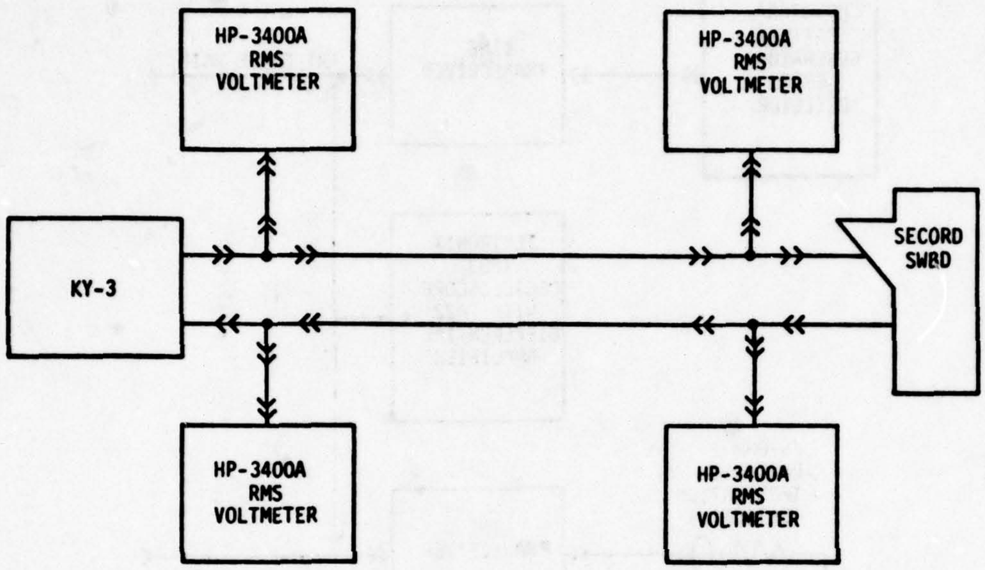


Figure 7-51. Nominal Data Levels (Operational Setup).

g. Set the KY-3 user equipment to operate in the wideband SECORD mode.

h. Record the data levels from the rms voltmeters.

7.13.13 Bit Error Rate.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-52 and allow for a 30-minute warmup and stabilization period.

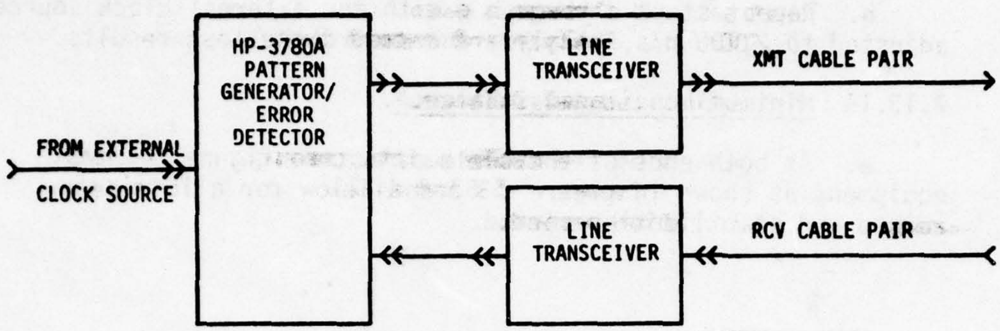


Figure 7-52. Bit Error Rate.

b. Adjust the HP-3780A pattern generator/error detector external clock sources for 50 kb/s.

c. Set the line transceivers for a 600-ohm line impedance.

d. Adjust the controls on the HP-3780A as follows:

(1) Set the BER COUNT switch to a block of 10 and the MEASUREMENT switch to BINARY.

(2) Set the CLOCK switch to EXT and the OUTPUT FORMAT switch to NRZ and CLOCK.

(3) Set the ZERO ADD/NORM/ERROR ADD switch to ERROR ADD.

(4) Set the ZEROS thumbwheel switches to 009 and the FREQUENCY OFFSET/NORM/EXT switch to NORM.

(5) Adjust the CLOCK THRESHOLD switch to AUTO and the DATA THRESHOLD switch to 200 mV.

e. Verify that the PRBS and GATING lamps are off and press the START button. The lamps should light at each end of the cable; ensure that the BER is 9.0×10^{-6} or 0.9×10^{-5} as read on the display.

f. Restart the test and record the BERs for 60 minutes.

g. Compute the BER and analyze the test results. The BER should be computed by taking the total number of bits transmitted

in the 60-minute period and dividing by the total number of errored bits. The BER should not exceed 1×10^{-7}.

h. Repeat steps d through g with the external clock source adjusted to 2,400 b/s. Analyze and record the test results.

7.13.14 Minimum Longitudinal Balance.

a. At both ends of the cable pairs, configure the test equipment as shown in figure 7-53 and allow for a 15-minute warmup and stabilization period.

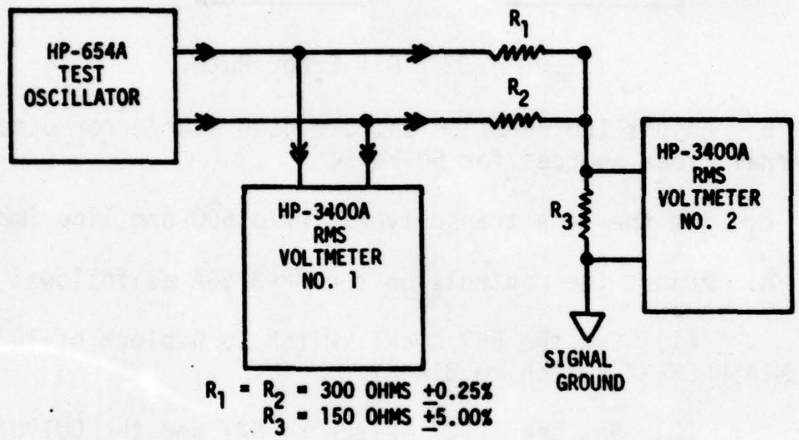


Figure 7-53. Longitudinal Balance Calibration Setup.

b. Adjust the test oscillator for an output signal of 2700 Hz at -10 dBm0 and 600 ohms balanced.

c. The level indicated on rms voltmeter No. 2 should be not less than -70 dBm0.

d. At both ends of the cable pairs, configure the test equipment as shown in figure 7-54 and allow for a 15-minute warmup and stabilization period.

e. Adjust the test oscillator for an output signal of 2700 Hz at -10 dBm0 and 600 ohms balanced.

f. Note the level indicated on rms voltmeter No. 3. Remove the test oscillator signal. The level indicated on rms voltmeter No. 3 should drop.

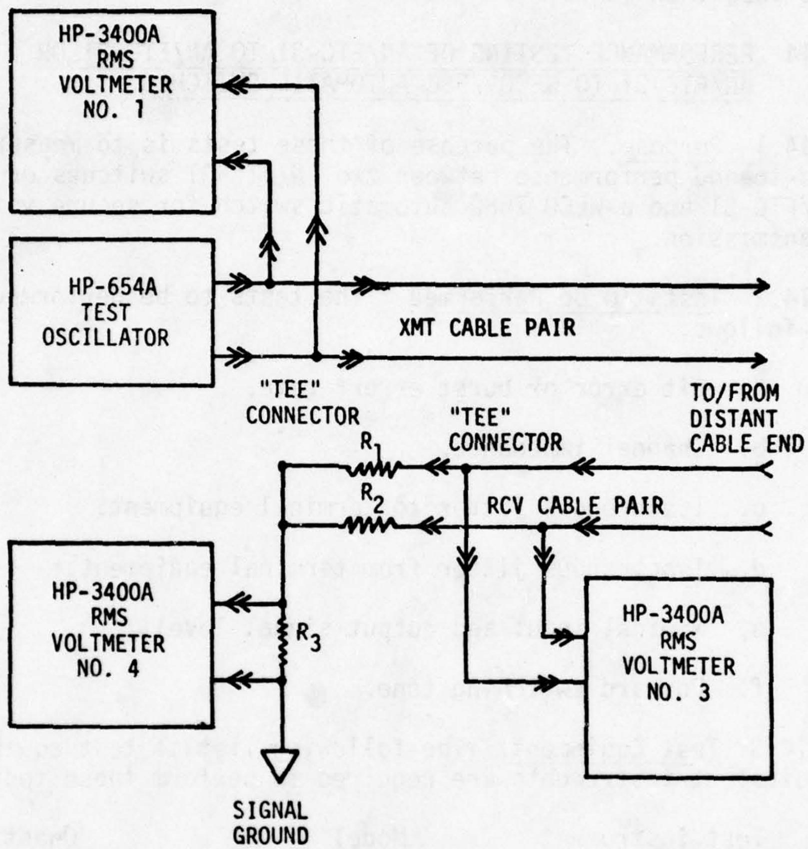


Figure 7-54. Longitudinal Balance Circuit Setup.

g. Record the levels indicated on rms voltmeters No. 2 and No. 3. The difference between the two indications is the longitudinal balance in dB. The longitudinal balance should be not less than 40 dB.

7.14 PERFORMANCE TESTING OF AN/FTC-31 TO AN/FTC-31 OR AN/FTC-31 TO WECO 758C AUTOMATIC SWITCHES.

7.14.1 Purpose. The purpose of these tests is to measure the end-to-end performance between two AN/FTC-31 switches or an AN/FTC-31 and a WECO 758C automatic switch for secure voice transmission.

7.14.2 Tests To Be Performed. The tests to be performed are as follows:

a. Bit error or burst error* rate.

b. Channel impedance.

c. Isochronous jitter to terminal equipment.

d. Isochronous jitter from terminal equipment.

e. Nominal input and output signal level.

f. Forward switching tone.

7.14.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Pattern generator/ error detector	HP-3780A	2	018
Thermal printer	HP-5150A	2	034
Telephone test set	AN/USM-181	1	053
Oscilloscope	Tektronix 7603	1	029
Oscilloscope amplifier	Tektronix 7A22	1	007

*Burst error measurements should be performed where instrumentation is available.

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	027
RMS voltmeter	HP-3400A	1	022

7.14.4 Bit Error or Burst Error Rate Procedure.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period.

b. Configure the test equipment at each switchboard location as shown in figure 7-55.

c. Calibrate the HP-3780A pattern generator/error detector as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZERO ADD/NORM/ERROR ADD	NORM
ZEROS	000
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^6
INPUT FORMAT	BINARY
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

d. Switch the block size to 10^8, press the START button, read and record the instantaneous bit error rates.

e. Restart the test and automatically record the BERs for a period of 48 hours.

f. Note and record the highest, lowest, and medium BERs.

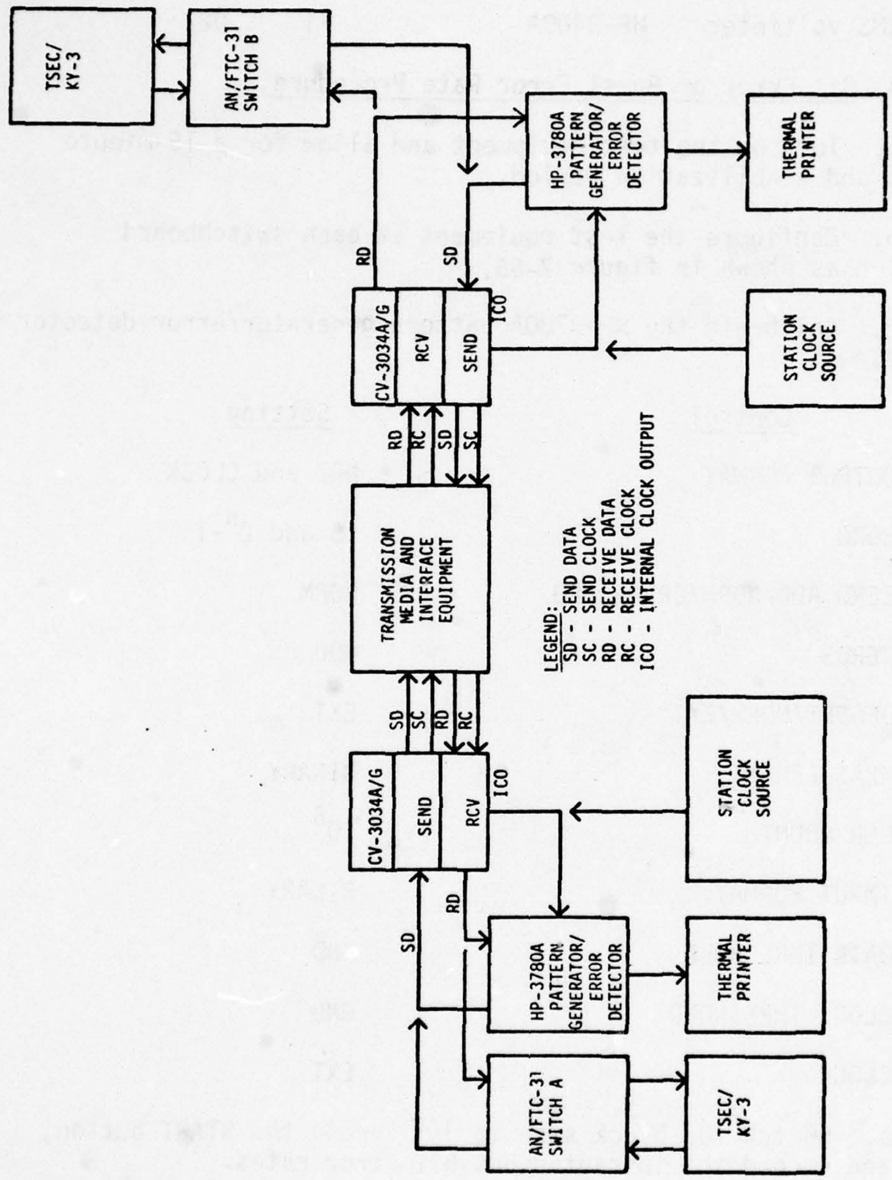


Figure 7-55. Bit or Burst Error Rate Test Setup.

g. Using the recorded data, plot a probability distribution curve and denote the BER at 95, 98.3, and 0.1 percent. These values are derived as follows:

(1) Note and record the total number of measurements (samples) taken, which should be approximately 87. The transmit block size (10^8) divided by the sampling rate (50 kb/s) equals 2,000 seconds divided by 60 seconds, which equals 33.3 minutes. This is further divided into the total number of minutes that measurements were performed (2,880 minutes). The total number of samples would equal approximately 87.

(2) Take the total number of times that the same BER was repeated and divide it by the total number of samples. Multiply that quotient by 100 percent.

h. Graphically plot the results and denote the BER at points of interest.

i. To determine the BER for the sampling period, proceed as follows:

(1) Compute the total number of bits transmitted; for example,

1×10^8 (block size) x 87 (samples) = 87×10^8.

(2) Compute the number of errors encountered at each sample and total the results for each sample. The number of errors for each sample is derived as follows:

(a) Errors = BER x block size.

(b) Let BER = 3×10^{-7}, block size = 1×10^8.

(c) Then errors = $3 \times 10^{-7} \times 10^8 = 30$.

j. Compute the bit error rate performances as follows:

(1) BER = total errors/87×10^8.

(2) Let total errors = 900.

(3) Then BER = $900/87 \times 10^8 = 1.03 \times 10^{-7}$.

k. As an objective, the long-term (95 percent) BER should not exceed one error in 10^{-7} and the short-term BER should not exceed one error in 10^{-4} more than 0.1 percent of the time.

7.14.5 Channel Impedance.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period.

b. Dial up the AN/FTC-31 switch from the local KY-3 and have the switchboard maintenance personnel establish permanent continuity from the KY-3 line side to the switchboard trunk side.

c. Switch off the ac power or turn off the KY-3 and configure the test equipment as shown in figure 7-56.

d. Tune the test oscillator to 25 kHz at 775 mV output and record the level (E_1). Connect the output of the test oscillator to the standard 135-ohm termination and record the voltage reading (E_2).

e. Repeat step d at the following test frequencies: 0.1, 1, 3, 5.5, 10, 18, 32, and 50 kHz.

f. Perform the same tests on the switch send side from the KY-3.

g. Configure the test equipment as shown in figures 7-57 and 7-58 and repeat steps d, e, and f.

h. The terminal impedance can be determined as follows:

(1) $\frac{E_1}{E_2} = \frac{Z_1}{Z_2}$.

(2) $Z_2 = \frac{E_2}{E_1} (Z_1)$.

(3) Let

$E_1 = 0.775$ V

$E_2 = 1.00$ V

$Z_1 = 135$ ohms (standard)

$Z_2 =$ unknown.

(4) Then

$$Z_2 = \frac{1.00}{0.775} (135) = 174.2 \text{ ohms.}$$

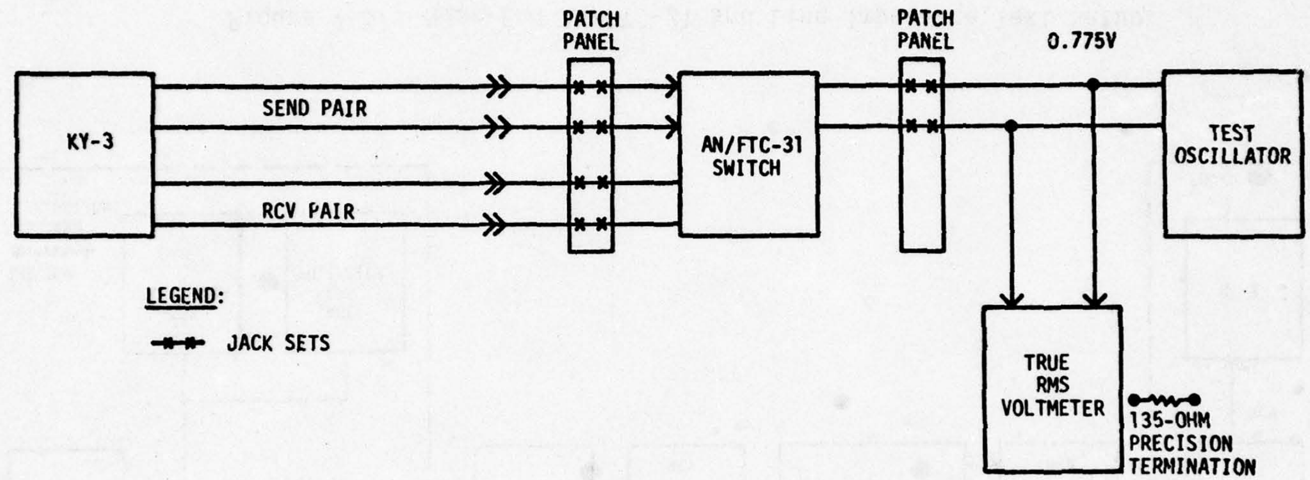


Figure 7-56. Channel Impedance Test Setup.

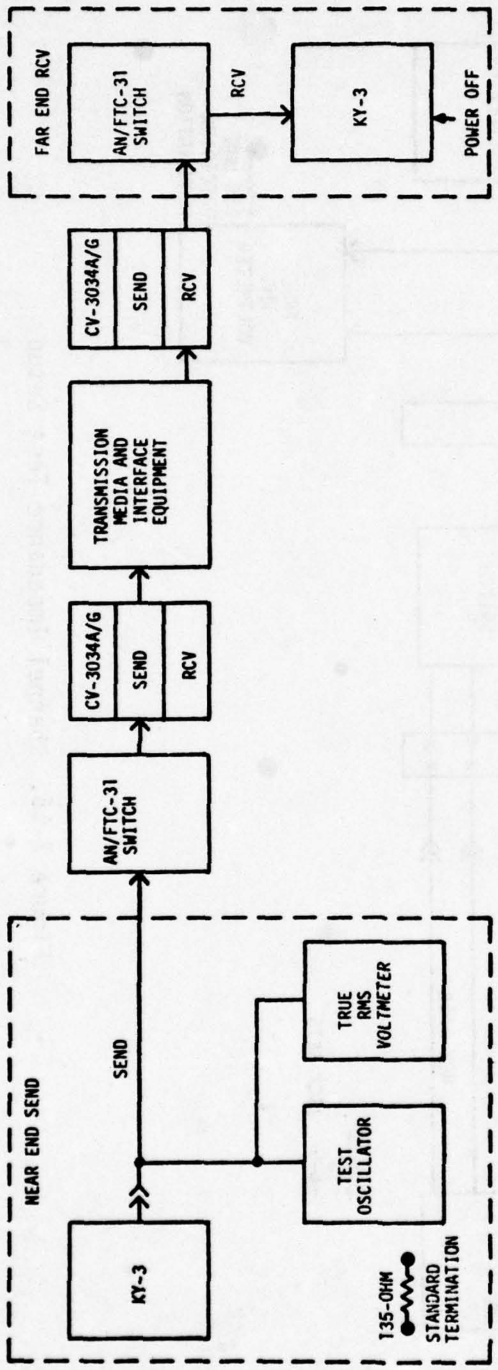
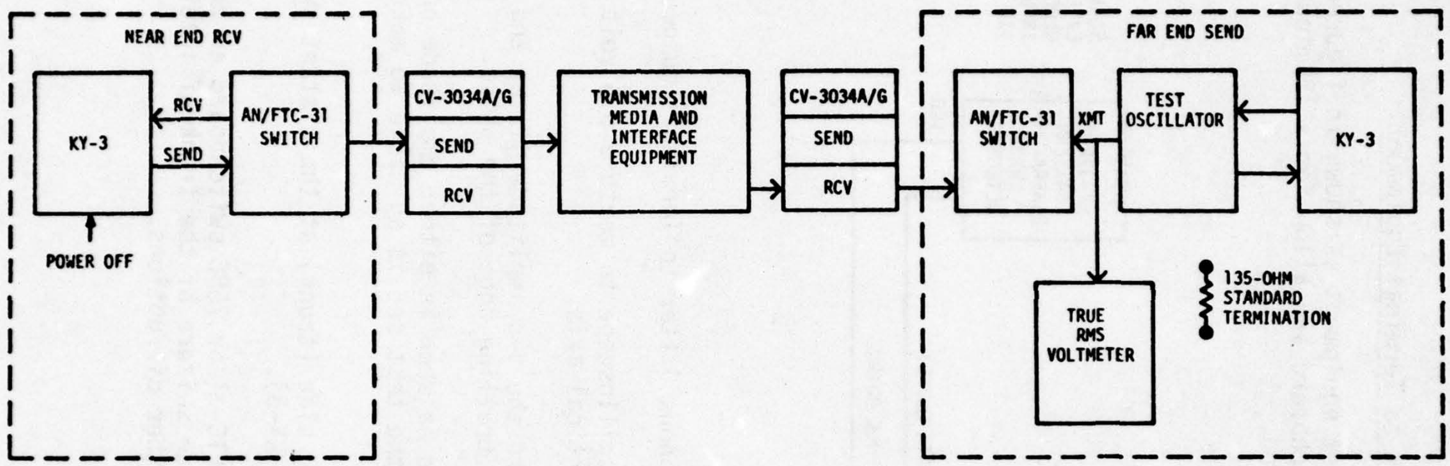


Figure 7-57. Near-End AN/FTC-31 and Line Impedance Test Setup.



NOTE: THE AN/FTC-31s SHOULD BE PROGRAMMED TO MAINTAIN PERMANENT CONTINUITY.

Figure 7-58. Far-End AN/FTC-31 and Line Impedance Test Setup.

7.14.6 Isochronous Jitter to Terminal Equipment.

a. Configure the test equipment as shown in figure 7-59 below at the distant switchboard and allow for a 15-minute warm-up and stabilization period.

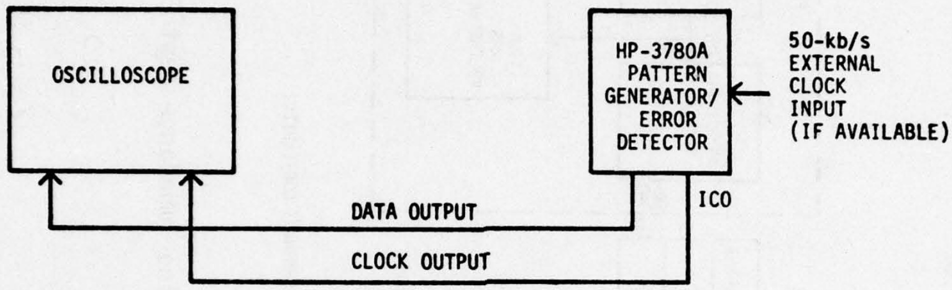


Figure 7-59. Isochronous Jitter to Terminal Equipment.

b. Calibrate the oscilloscope to measure 0.5 volt and 36 degrees per cm on the vertical axis.

c. Denote and record the p-p amplitude jitter and p-p phase jitter on the leading or trailing edge of the phase.

d. No smears should be seen in either amplitude or phase. This check ensures that the test set is suitable to make the measurement.

e. Connect the line side (trunk) at the distant switchboard to the KY-3 (maintenance KY-3).

f. Program the AN/FTC-31 or 758C switchboard as required to establish a flash-override seizure of the trunk of interest, to preclude preemption or other disruptions.

g. Connect the output of the CV-3034A/G converter to the vertical axis of the oscilloscope. The test equipment and circuits should be configured as shown in figure 7-60.

h. Measure the amplitude and phase jitter seen on the peak of the pulse and the trailing or leading edge, which would appear as a smear. The width or height of the smear--as compared to the calibration factor--is equal to the p-p amplitude or phase jitter, as applicable.

i. If the smear on the leading or trailing edge is 0.2 cm, then the phase jitter is equal to 7.2 degrees, as shown below:

$$10\text{ cm} = 360\text{ degrees}$$

$$0.2\text{ cm} = X\text{ degrees}$$

$$X = \frac{72}{10} = 7.2\text{ degrees.}$$

Assume that the amplitude smear riding the top of the signal is 0.5 cm; then the p-p voltage is 250 mV (E_1). If the pulse level is 6V p-p, the S/N ratio can be derived as follows:

(1) $E_1 = 250$ mV.

(2) $E_2 = 6000$ mV.

(3) Then

$$S/N = 20 \log \frac{E_2}{E_1} \text{ (dB)}$$

$$= 20 \log 24 = 20\ (1.3802) = 27.6\text{ dB.}$$

j. At the subscriber CV-3034A/G, configure the converter for a loopback. The test trunk should be as shown in figure 7-61.

k. Measure the amplitude and phase jitter emanating from the distant switchboard as delineated in steps h and i above. Compare the values with the results obtained in steps h and i and denote the differentials picked up through the transmission media.

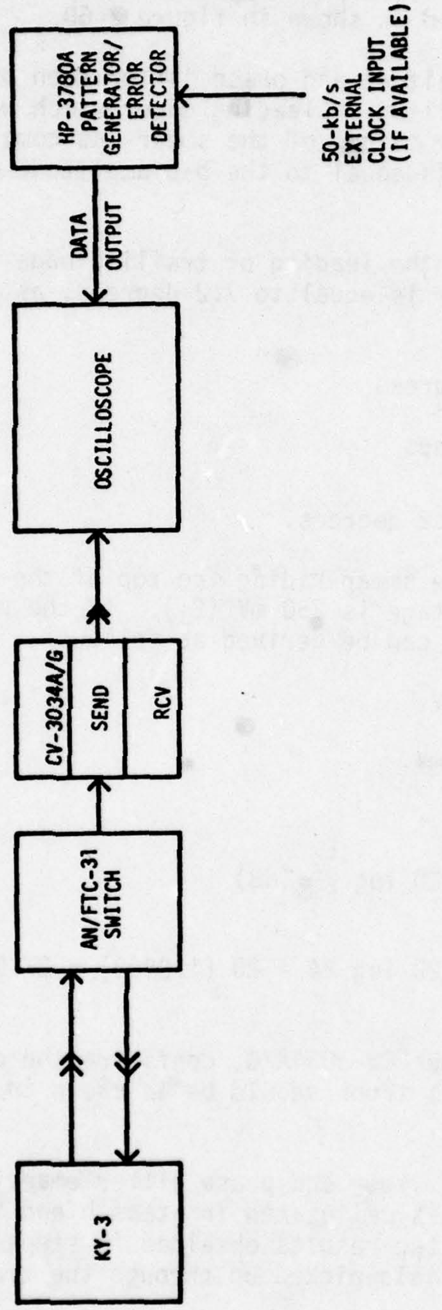


Figure 7-60. AN/FTC-31 Trunk Amplitude and Phase Jitter Test Setup.

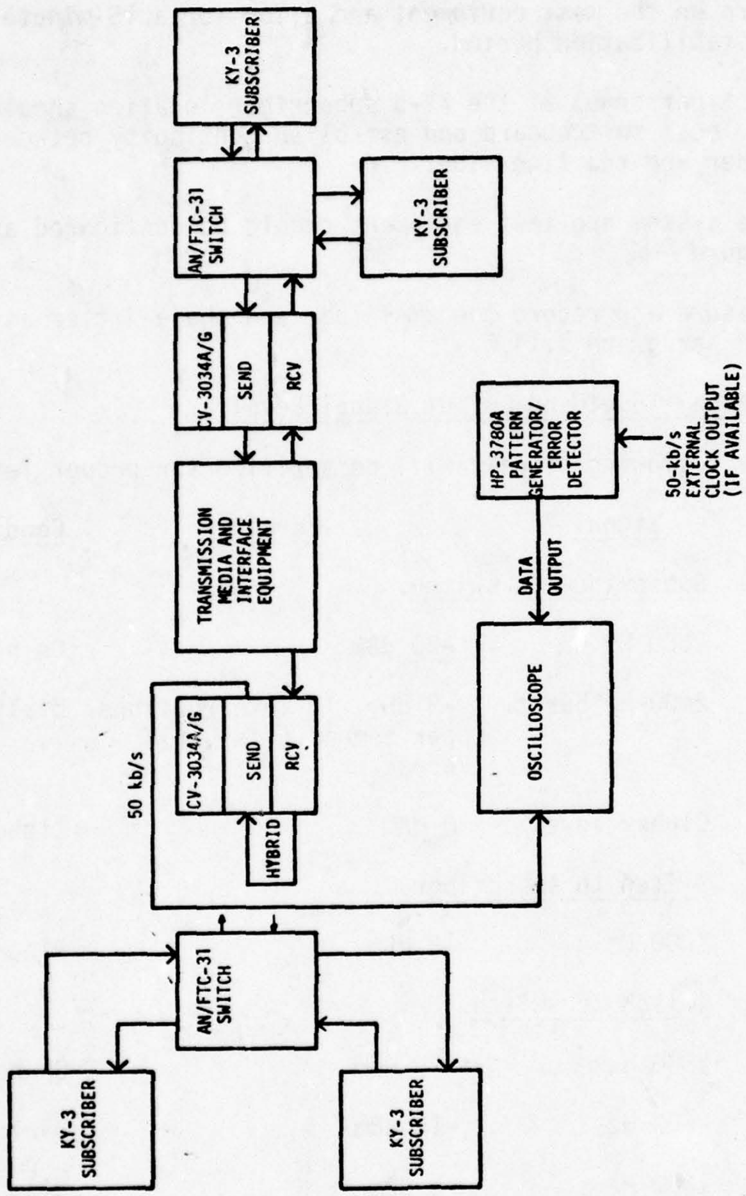


Figure 7-61. Distant Station Loopback Amplitude and Phase Jitter Test Setup.

7.14.7 Isochronous Jitter from Terminal Equipment.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period.

b. Test personnel at the KY-3 subscriber location should dial up the local switchboard and establish continuity between the subscriber and the line side.

c. The system and test equipment should be configured as shown in figure 7-62.

d. Measure and record the amplitude and phase jitter as described in paragraph 7.14.6.

7.14.8 Nominal Input and Output Signal Level.

a. The following signals will be verified for proper levels:

Signal	Level	Condition
(1) Subscriber to switch.		
2600 Hz	-20 dBm	On hook
2600-Hz burst	-9 dBm, 10 interruptions per second (i/s), 61% break	Dialing
Cipher level	0 dBm	Cipher
(2) Switch to subscriber.		
1000 Hz	-6 dBm	Ring tone
(3) Switch to switch.		
2600 Hz	-20 dBm	On hook
600 Hz	-15 dBm	Dial tone
1000 Hz	-6 dBm	Ring tone
800 Hz	-15 dBm	Preempt
2600-Hz burst	-9 dBm, 10 i/s, 61% break	Dialing

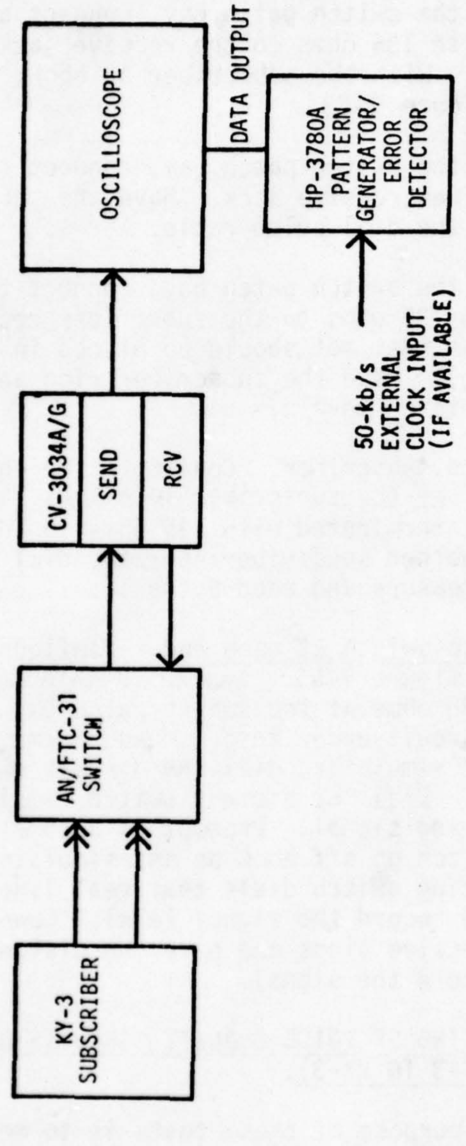


Figure 7-62. Isochronous Jitter from Terminal Equipment.

b. Signal tones, as listed above, will be sent between the KY-3 subscriber and switch or switch to switch, and measurements will be made at the receiving end.

(1) Subscriber to switch.

(a) At the switch patch bay, connect a telephone test set terminated with 135 ohms to the receive jack of the subscriber under test. With the subscriber on hook, measure the 2600 Hz as shown in figure 7-63.

(b) At the switch patch bay, connect the oscilloscope to the subscriber receive jack. Have the subscriber dial zero and measure the dial pulse ratio.

(c) At the switch patch bay, connect the telephone test set terminated in 135 ohms to the subscriber receive jack. The 5-kHz switch on the test set should be placed in the up position (greater than). Have the subscriber ring and go off hook and measure the cipher levels.

(2) Switch to subscriber. Configure the equipment as shown in figure 7-64. At the subscriber location, connect the telephone test set terminated with 135 ohms to the subscriber receive line. Have another subscriber/operator dial the subscriber under test. Measure and record the level.

(3) Switch to switch at each end. Configure the test equipment as shown in figure 7-65. Connect a telephone test set terminated with 135 ohms at the switch patch bay to the receive jack of the circuit under test. Measure the 2600-Hz idle signal. From the simulator, dial the distant switch and measure the dial tone. Dial the distant switch simulator real line and measure the ring signal. Preempt is accomplished by having the distant switch go off hook on any simulator real line, and the originating switch dials that real line using a priority. Measure and record the signal level. Connect the oscilloscope to the receive lines and have the distant end dial zero. Measure and record the signal.

7.15 PERFORMANCE TESTING OF VOICE QUALITY CIRCUITS BETWEEN SWITCHBOARDS (KY-3 TO KY-3).

7.15.1 Purpose. The purpose of these tests is to measure the voice quality performance of circuits between local and distant KY-3 users and switchboards.

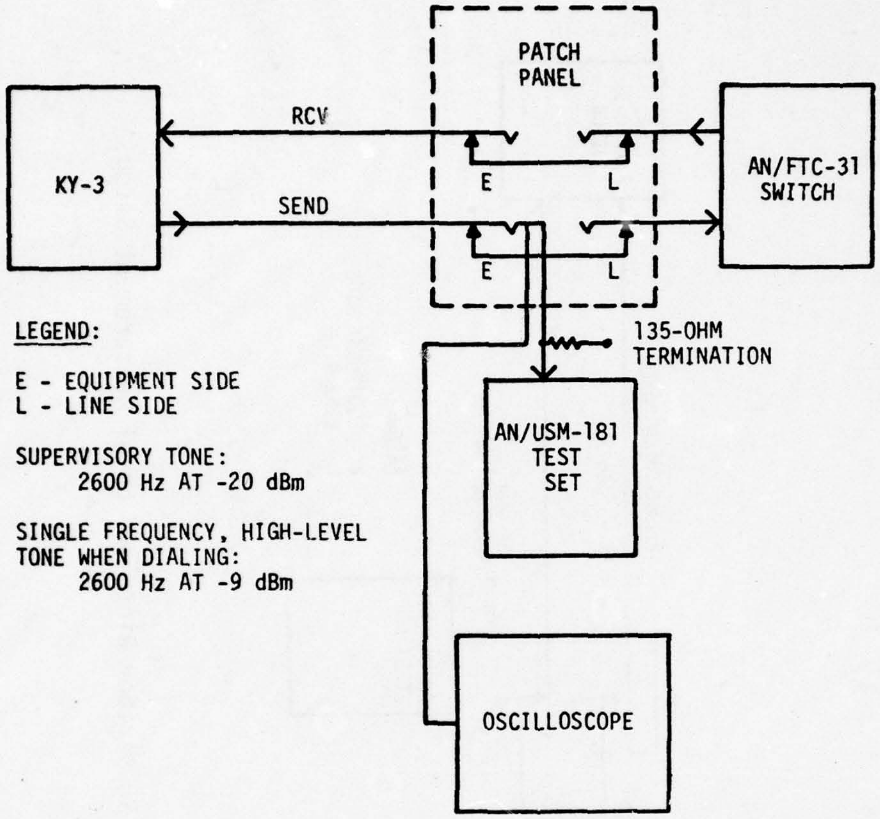


Figure 7-63. Subscriber to Switch 2600-Hz Supervisory Tone and Dial Pulse Measurement Setup.

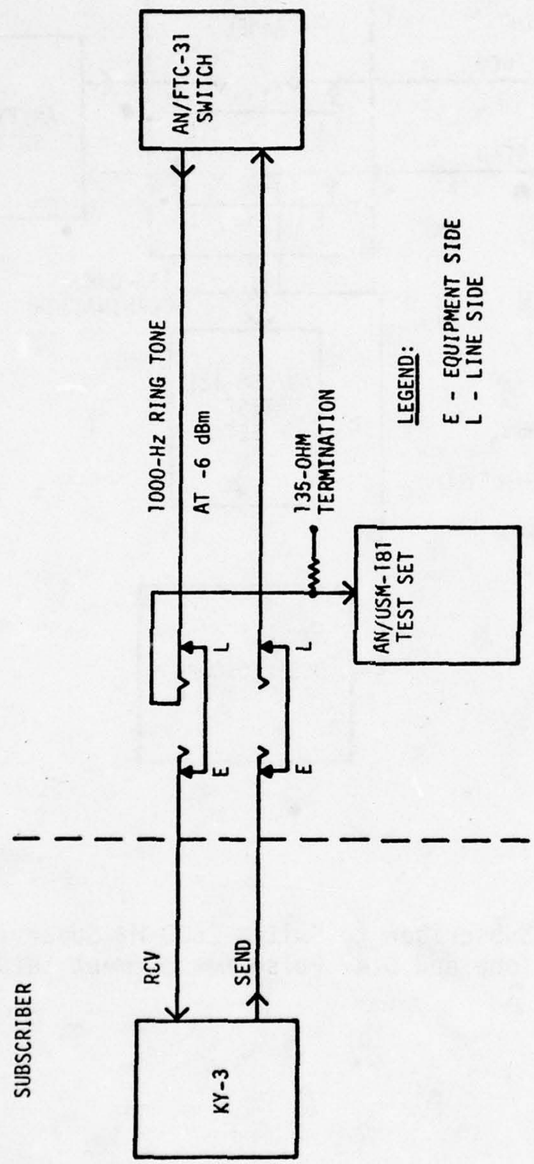
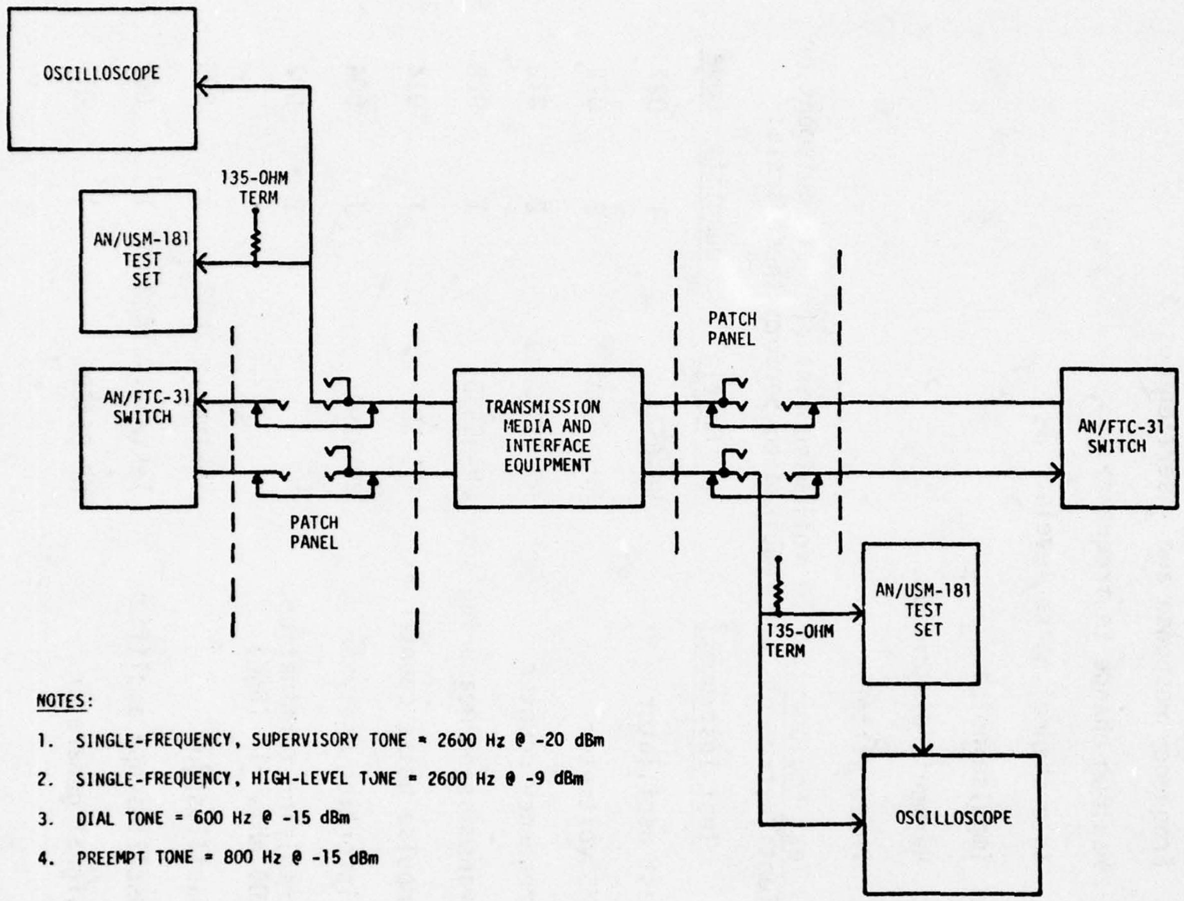


Figure 7-64. Subscriber Ring Tone Level Measurement Setup.



NOTES:

1. SINGLE-FREQUENCY, SUPERVISORY TONE = 2600 Hz @ -20 dBm
2. SINGLE-FREQUENCY, HIGH-LEVEL TONE = 2600 Hz @ -9 dBm
3. DIAL TONE = 600 Hz @ -15 dBm
4. PREEMPT TONE = 800 Hz @ -15 dBm

Figure 7-65. Switch to Switch Tone Level and Pulsing Measurement Setup.

7.15.2 <u>Tests To Be Performed</u>. The tests to be performed are as follows:

a. Frequency response and insertion loss.

b. Maximum change in frequency.

c. Idle channel noise levels.

d. Impulse noise.

e. Harmonic distortion.

f. Phase jitter.

7.15.3 <u>Test Equipment</u>. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	027
RMS voltmeter	HP-3400A	2	022
Frequency counter	HP-5340A	2	013
Transmission measuring set	HP-3555B	1	028
Impulse noise counter	TTS-58	1	014
Distortion analyzer	HP-339A	1	004
Precision termination, 600 ohms $\pm 1\%$ (BNC)		2	037
Oscilloscope	Tektronix 7603	1	029
Oscilloscope amplifier	Tektronix 7A22	1	007
Signal generator	HP-8640B	1	019

7.15.4 Circuit Continuity.

a. The performance of the tests requires that circuit continuity be maintained from user location to user location through any intervening switchboards.

b. Establish a secure call from the local KY-3 user location to the distant end location.

c. Coordinate with the switchboard maintenance personnel to program the switchboard trunk under test for a flash-override priority. This will prevent preemption or other operational interruptions during the test period.

7.15.5 Frequency Response and Insertion Loss.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-66 and allow for a 15-minute warmup and stabilization period.

b. Adjust the test oscillators for an output signal of 1000 Hz at -10 dBm0 and 600 ohms balanced.

c. Record the level as shown on the rms voltmeter.

d. Repeat steps b and c at the following frequencies: 300, 400, 500, 700, 1000, 1300, 1600, 1900, 2200, 2500, 2800, 3000, 3100, 3200, 3300, and 3400 Hz.

e. Plot a frequency versus amplitude response curve and indicate the 3-dB points on the curve.

7.15.6 Maximum Change in Frequency.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-67 and allow for a 30-minute warmup and stabilization period.

(NOTE: If an accurate frequency standard is available, check the accuracy of the internal standard in the frequency counters at the transmitting and receiving stations. This is accomplished by measuring the output of the standard with the frequency counters. If the frequency counter reading is not with $\pm$0.1 Hz of the rated frequency of the standard, the internal standard of the counter should be adjusted within these limits.)

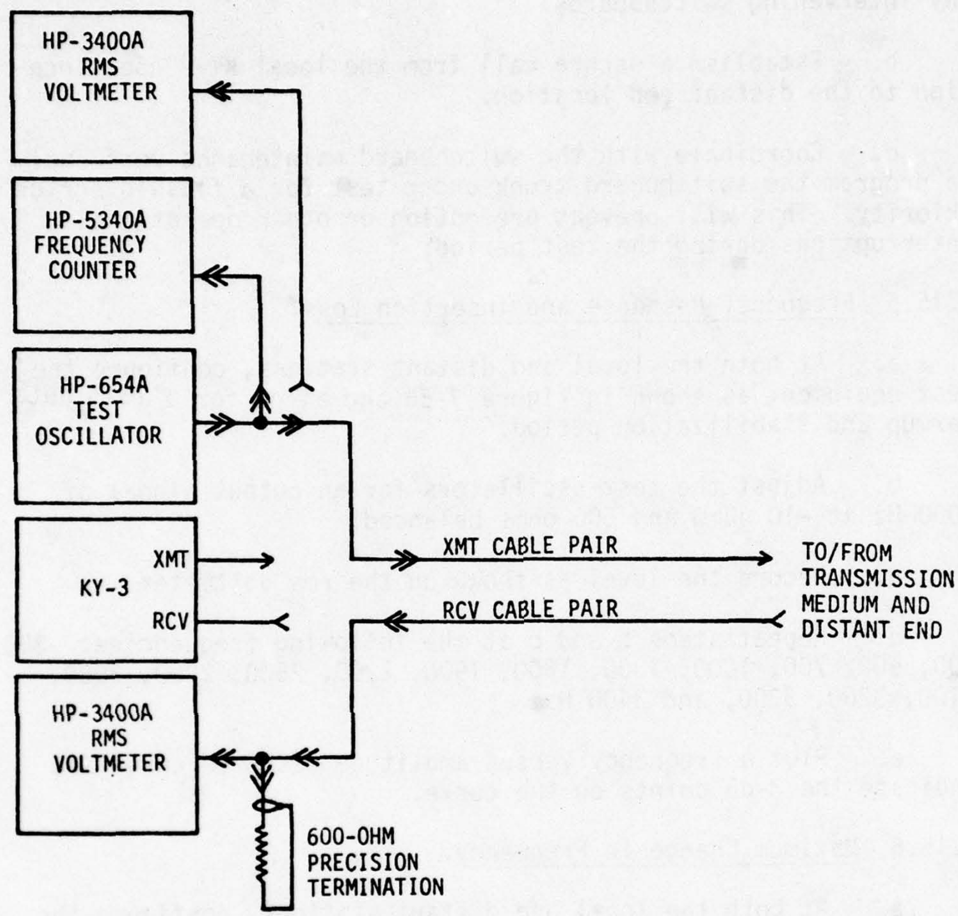


Figure 7-66. Frequency Response and Insertion Loss.

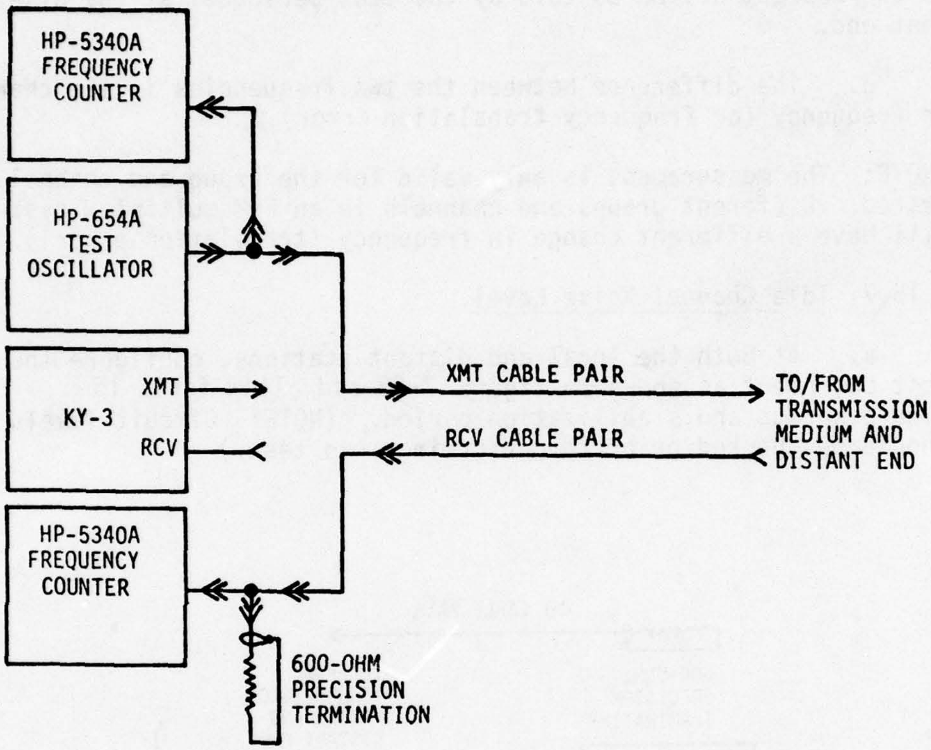


Figure 7-67. Maximum Change in Frequency (Translation Error).

b. Adjust the test oscillators for an output signal of 1000 Hz at -10 dBm0 and 600 ohms balanced.

c. Record the frequency of the received signal to the nearest 0.1 Hz while confirming the frequency of the transmitted signal to the nearest 0.1 Hz as told by the test personnel at the distant end.

d. The difference between the two frequencies is the change in frequency (or frequency translation error).

(NOTE: The measurement is only valid for the group and channel tested. Different groups and channels in an FDM multiplex system will have a different change in frequency [translation error]).

7.15.7 Idle Channel Noise Level.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-68 and allow for a 15-minute warmup and stabilization period. (NOTE: Circuit levels should be checked prior to performing this test.)

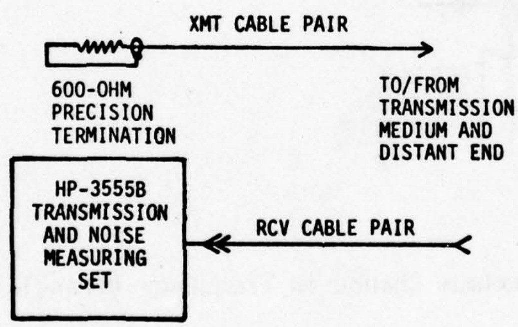


Figure 7-68. Idle Channel Noise.

b. Configure the HP-3555B transmission and noise measuring set for C-message noise weighting and a 600-ohm terminated input.

c. Record the noise level in dBrnC0.

7.15.8 Impulse Noise.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-69 and allow for a 15-minute warmup and stabilization period. (NOTE: Circuit levels should be checked and idle channel noise levels should be measured prior to performing this test.)

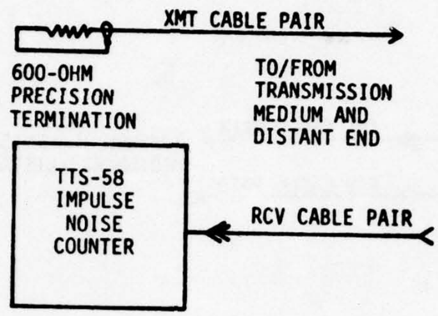


Figure 7-69. Impulse Noise.

b. Set the controls on the TTS-58 impulse noise counter as follows:

Control	Setting
INPUT	600 ohms
WEIGHTING	C-message
BRDG/TERM	TERM
HOLD	ON

c. Adjust the low-level counter threshold to the idle channel noise level recorded in paragraph 7.15.7c. Adjust the mid-level counter threshold for 3 dBrn above the low-level counter. Adjust the high-level counter threshold for 6 dBrn above the low-level threshold.

d. Set the timer for 15 minutes and start the test.

e. At the end of the 15-minute test period, record the impulse hits from the counters.

7.15.9 Harmonic Distortion.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-70 and allow for a 15-minute warmup and stabilization period.

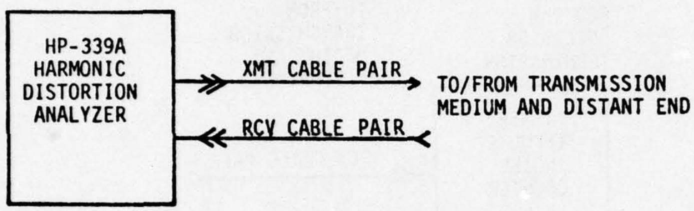


Figure 7-70. Harmonic Distortion.

b. At the transmitting station, adjust the distortion analyzer for an output signal of 700 Hz at -10 dBm0 and 600 ohms balanced.

c. At the receiving station, adjust the distortion analyzer receiver to null out the 700 Hz fundamental and record the total harmonic noise distortion in percent and in dBm0.

7.15.10 Phase Jitter.

a. At both the local and distant stations, configure the test equipment as shown in figure 7-71 and allow for a 15-minute warmup and stabilization period.

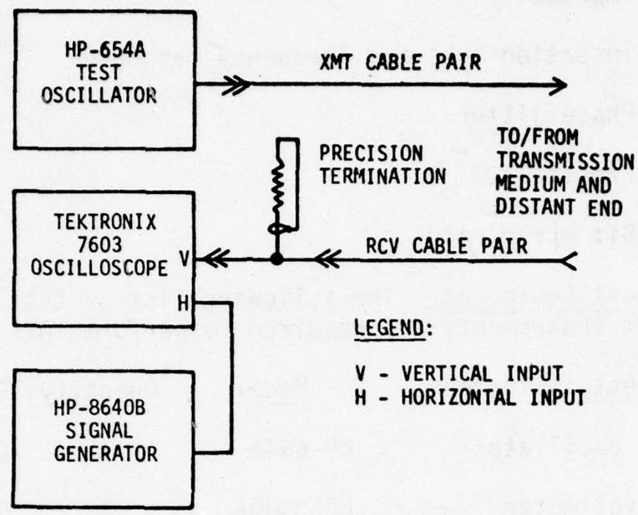


Figure 7-71. Phase Jitter.

b. Adjust the test oscillators for an output signal of 1000 Hz at -10 dBm0 and 600 ohms balanced.

c. Adjust the HP-8640B signal generators for an output signal of 1000 Hz at -10 dBm.

d. Adjust the horizontal sync, horizontal gain, and vertical gain controls on the oscilloscope to display one complete waveform.

e. Measure the p-p phase jitter in degrees as smear from the horizontal axis of the oscilloscope display. If one full cycle is displayed across 10 cm, then 1 cm is equal to 36 degrees. If the amount of smear is 0.2 cm, then the p-p phase jitter is 7.2 degrees.

7.16 PERFORMANCE TESTING OF VIDEO CABLES.

7.16.1 Purpose. The purpose of this test is to measure the performance of the video cables associated with the transmission and reception of automatic secure voice communications.

7.16.2 Tests To Be Performed. The tests to be performed are as follows:

a. Impedance.

b. Insertion loss and frequency response.

c. Phase jitter.

d. Crosstalk.

e. Bit error rate.

7.16.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform this test:

Test instrument	Model	Quantity	Code
Test oscillator	HP-654A	1	027
RMS voltmeter	HP-3400A	2	022
Variable attenuator	HP-355C	1	008
Precision termination, 75 ohms ±1%		2	038
Phase jitter meter	HLI-48	1	026
Frequency selective voltmeter	HP-312D	1	023
Pattern generator/ error detector	HP-3780A	2	018
Frequency counter	HP-5340A	1	013

7.16.4 Impedance (Z) Measurement Procedure.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period. If the cable is being used to transmit analog or digital signals, determine the frequency band of interest and proceed as follows. (NOTE: 1 to 108 kHz at 75 ohms unbalanced will be used for discussion purposes. For other impedances, balanced or unbalanced, the procedure is identical, except for the terminating resistors which should match the nominal characteristic impedance of the cable under test.)

b. Terminate the distant end of the cable with a 75-ohm nonreactive precision termination and configure the test equipment as shown in figure 7-72.

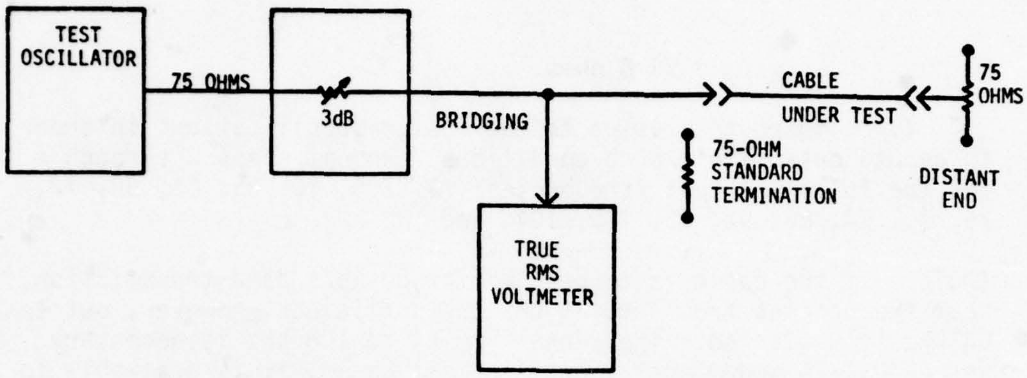


Figure 7-72. Impedance Measurement Setup.

c. Terminate the output of the test equipment with a 75-ohm precision termination (standard) and adjust the test oscillator for a 0.775-mV output at 60 kHz as observed on the rms voltmeter. Record the voltage reading (E_1).

d. Terminate the distant end of the cable under test with a 75-ohm $\pm 1\%$ standard termination. Without disturbing the test equipment settings, connect the termination to the near end of the cable. Record the rms voltmeter reading (E_2) at 60 kHz.

e. The impedance of the cable can be determined at 60 kHz as follows:

$$\frac{E_1}{E_2} = \frac{Z_1}{Z_2} .$$

Let

$$E_1 = 775 \text{ mV}$$

$$E_2 = 1000 \text{ mV}$$

$$Z_1 = 75 \text{ ohms}$$

$$Z_2 = \text{unknown}.$$

Then

$$\frac{775}{1000} = \frac{75}{Z_2}$$

$$0.775Z_2 = 75$$

$$Z_2 = 96.8 \text{ ohms.}$$

f. Compare this value to the design specifications in order to denote out-of-tolerance conditions. Repeat steps c through e for the following test frequencies: 1, 2.5, 10, 25, 64, 68, 72, 76, 80, 84, 88, 92, 96, 100, 104, and 108 kHz.

(NOTE: If the cable is to be used for 50-kb/s data transmission, test frequencies from 1 to 25 kHz are sufficient; however, out to 64 kHz is preferred. The range from 64 to 108 kHz is necessary for AN/USC-26 modem operation. In most cases, it is desirable to know the impedance over the entire range of frequencies listed above.)

g. Terminate the distant end of the cable with the normal C-E equipment and repeat steps c through f.

7.16.5 Insertion Loss and Frequency Response.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period. (NOTE: For discussion purposes, a 75-ohm unbalanced cable and a frequency range of 1 to 108 kHz will be used. For other impedances, balanced or unbalanced, the procedure is identical, except for the terminating resistor which should match the nominal characteristic impedance of the cable under test.)

b. Configure the test equipment as shown in figure 7-73.

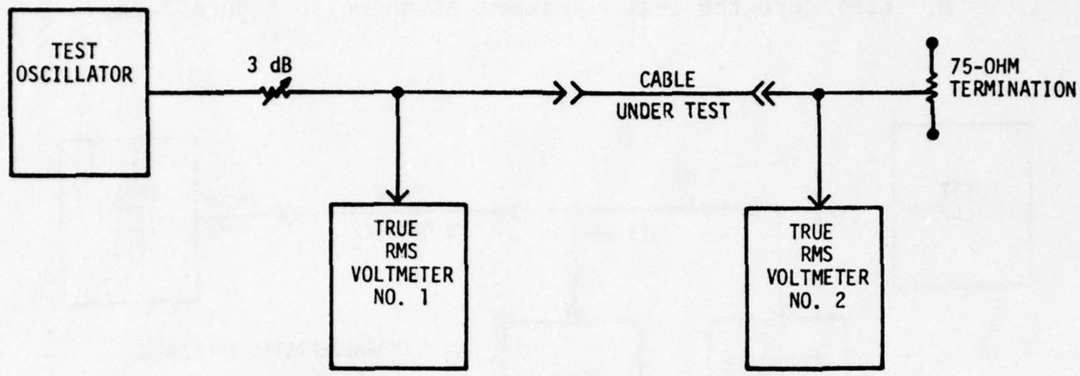


Figure 7-73. Insertion Loss and Frequency Response.

c. Connect the test equipment to the terminated cable and tune the test oscillator to 10 kHz with an output power level of -13 dB as observed on rms voltmeter No. 1.

d. Record the power level received at the distant end.

e. Compute the cable insertion loss, L_s, as follows:

$$L_s = \text{input power - output power.}$$

Example: If the input level is -13 dBm and the distant end receive level is -16 dBm, the insertion loss is 3 dB at 60 kHz.

f. Repeat steps c through e at the test frequencies listed in paragraph 7.16.4f. Analyze the test results and denote substandard performance levels.

g. Plot a frequency versus amplitude curve with all levels referenced to 84 kHz. This plot will display the frequency response which should be compared to design levels.

7.16.6 Phase Jitter Measurement Procedure.

a. Turn on the test equipment and allow for a 15-minute warmup and stabilization period.

b. Configure the test equipment as shown in figure 7-74.

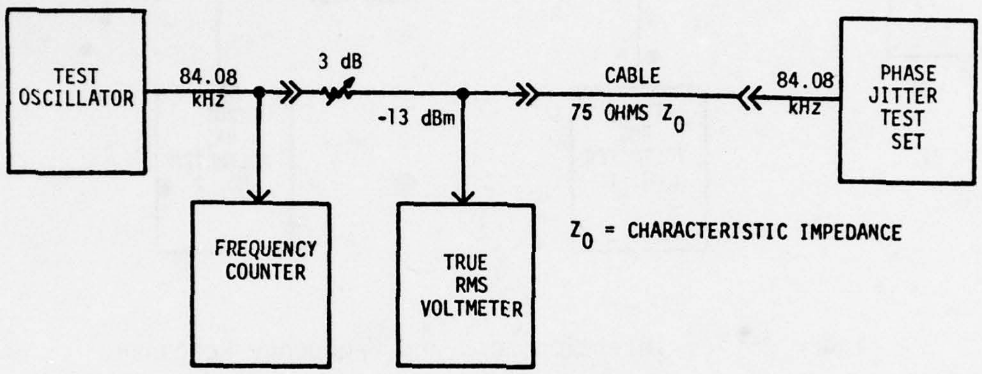


Figure 7-74. *Phase Jitter and Hit Test Setup for Cables Used for Analog Signal Transmission.*

c. Adjust the controls on the HLI-48 phase jitter test set as follows:

Control	Setting
COINCIDENCE counter	0000
DROPOUTS counter	0000
PHASE HITS counter	0000
AMPLITUDE HITS counter	0000
HIT DELAY adjustment	OUT
METER selector	30° (peak)
FREQUENCY selector	84.08 kHz

Control	Setting
PEAK DEGREES selector	15°
±dB switch	2
TIMER switch	0

d. Tune the test oscillator to 84.08 kHz as shown on the frequency counter. Set the output level to -13 dBm as shown on the rms voltmeter.

e. Set the TIMER switch on the phase jitter test set to 15 minutes.

f. Upon completion of the 15-minute test period, record the amplitude hits, phase hits, coincidental phase hits, and instantaneous phase jitter as read on the phase jitter test set.

g. When testing cables for digital signal transmission, proceed as follows:

(1) Tune the test oscillators for an output frequency of 25 kHz (50 kb/s) or one-half of the expected data rate. The transmit level should be -10 dBm.

(2) Configure the test equipment as shown in figure 7-75.

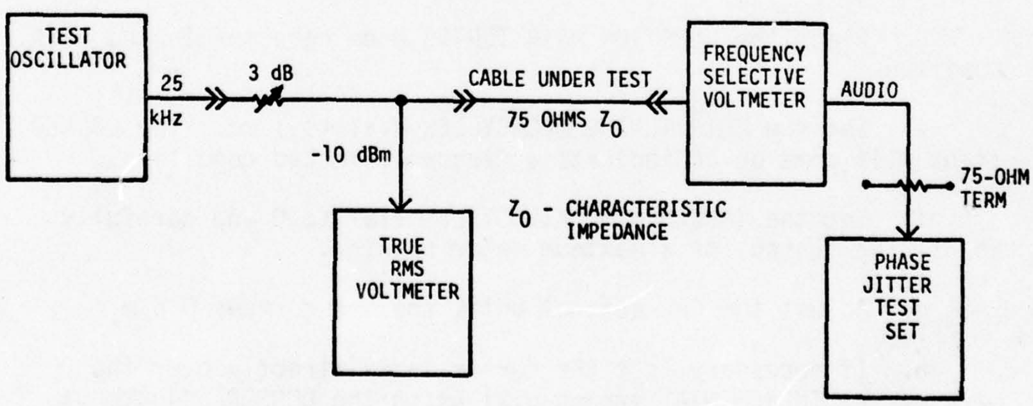


Figure 7-75. Phase Jitter and Hit Test Setup for Cables Used for Digital Signal Transmission.

(3) Readjust the phase jitter test set as specified in paragraph 7.16.6c.

(4) Calibrate the frequency selective voltmeter in accordance with the instructions in paragraph 7.16.6.1. Adjust the FSVM as detailed in paragraph 7.16.6.2 to measure the 25-kHz test tone.

(5) Set the TIMER switch on the phase jitter test set to 15 minutes.

(6) After completion of the 15-minute test period, record all pertinent test data and compare the measured values to design levels.

7.16.6.1 Operational calibration of FSVM. NOTE: This procedure for operational calibration sets the overall sensitivity of the voltmeter for all of its ranges. The highly stabilized gain reference oscillator--the output of which is nominally within ± 0.1 dB under ambient room conditions--is used as the standard. Level calibration must be performed at the 1-MHz frequency only. Proceed as follows:

a. Set the INPUT DBM-VOLT attenuator to CAL (full clockwise rotation).

b. Set the INPUT IMPEDANCE selector to CAL-75.

c. Set the SELECTIVITY switch to NARROW.

d. Place the FUNCTION MAIN TUNING mode selector in the LOCK position.

e. Set the MAIN TUNING MEGACYCLES dial to 1 mc. The LOCKED light will come on to indicate a frequency locked condition.

f. Set the INCREMENTAL KILOCYCLES dial to 0 and carefully adjust the tuning for a maximum meter reading.

g. Adjust the CAL control until the meter reads 0 dBm.

h. If necessary, set the cursor index directly over the 0 mark on the INCREMENTAL tuning dial using the CURSOR adjustment. If it is desired to set the cursor on the MAIN TUNING dial, set the dial in the locked condition at 1 mc (or any harmonic), so that it is halfway between the points at which it goes out of lock. With the CURSOR adjustment, set the index directly under the 1-mc scale division mark, or at any of the harmonics of 1 mc.

7.16.6.2 FSVM measurement procedure.

a. Calibrate the FSVM as described in paragraph 7.16.6.1.

b. As a precautionary measure, turn the INPUT DBM-VOLTS attenuator full clockwise to ± 30 dBm (or CAL) before a connection is made to the line or circuit.

c. Set the INPUT impedance selector to the nominal characteristic impedance of the line or circuit to be checked, or to 600 ohms if voltage is to be measured.

d. Set the INPUT mode selector to BRG if the measurement is to be made across a line or circuit already terminated. Set the selector to TERM if the line must be terminated in its characteristic impedance.

e. If the frequency of the desired signal is known, proceed as follows:

(1) Set the SELECTIVITY switch to WIDE.

(2) Set the FUNCTION MAIN TUNING mode selector to LOCK.

(3) Set the INPUT DBM-VOLTS attenuator to the approximate expected signal level.

(4) Set the INCREMENTAL tuning dial to 0 kc.

(5) Set the MAIN TUNING frequency dial to the nearest 100-kc lock point below the signal frequency.

(6) Adjust the INCREMENTAL tuning dial for a maximum meter reading.

(7) Adjust the attenuator for a meter reading between -10 and +2 dB.

(8) Set the SELECTIVITY switch to NARROW and again adjust the INCREMENTAL tuning dial for a maximum meter reading.

f. If the signal frequency to be measured is not known or only approximately known, proceed as follows:

(1) Follow procedure steps (1) through (4) as given in paragraph e above, except that the MAIN TUNING mode selector should be set to CONT.

(2) Rotate the MAIN TUNING dial until an indication is seen on the meter. If necessary, set the attenuator to progressively lower (greater sensitivity) levels and search for the signal until a meter indication is obtained. Reduce the sensitivity if meter "kick" seems large when passing over the signal. A signal 20 dB below the attenuator setting may be readily found with careful tuning.

(3) Set the MAIN TUNING mode selector to LOCK and follow procedures (5) through (8) in paragraph e above.

g. Readout.

(1) DBM levels. Assuming the INPUT impedance selector is set to the proper line impedance and the line is properly terminated, the signal level is the algebraic sum of the attenuator dB setting and the meter reading. For example, with the attenuator at -20 dBm and the meter at +1 dBm:

$$(-20) + (+1) = -19 \text{ dBm}.$$

(2) Voltage levels. Assume that the INPUT impedance selector is set to 600 ohms and the line is properly terminated. The meter has two voltage scales, 0-1 and 0-3. The attenuator range settings 100μ, 1m, .01, .1, 1, and 10 volts apply to the 0-1 scale. The range settings 30μ, 300μ, 3m, .03, .3, 3, and 30 volts apply to the 0-3 scale. Each attenuator range setting refers to the maximum voltage that can be read on the appropriate meter scale. For example, if the attenuator is set at 1m and the meter is at .8, read 0.8 mV or 800 μV; if the attenuator is at .03 and the meter at 1.5, read 0.015 V.

(3) Frequency. The frequency to which the voltmeter is tuned is the sum of the MAIN TUNING dial indication in mc plus the INCREMENTAL tuning dial indication in mc (kc reading converted to mc). For example, with the MAIN TUNING dial at 11.3 mc and the INCREMENTAL tuning dial at 34.5 kc, frequency = 11.3 mc + 0.0345 mc = 11.3345 mc.

7.16.7 Crosstalk.

a. Turn on all test equipment and allow for a 15-minute warmup and stabilization period. Note that this test procedure is applicable to both shielded-pair coaxial or twinaxial cables.

b. Configure the test equipment as shown in figure 7-76.

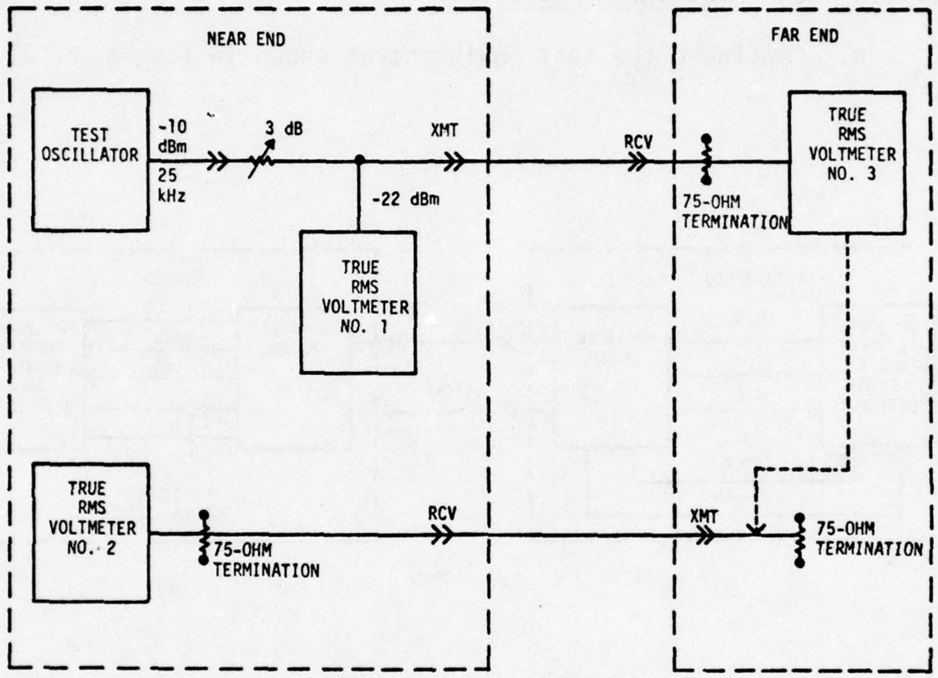


Figure 7-76. Crosstalk Test Setup.

c. Measure and record the level on the receive (voltmeter No. 2) cable at the near-end station.

d. Remove the test tone and terminate the input to the transmit cable. Measure the noise level on the receive cable (voltmeter No. 2). If no changes are detected, the crosstalk level is below the basic noise on the cable. The near-end crosstalk level should be 50 dB below the transmit level.

e. Reconnect the test tone. At the far-end station, measure the receive level on voltmeter No. 3. Record the value.

f. Connect voltmeter No. 3 to the transmit line and record the value.

g. At the near-end station, disconnect the test oscillator and terminate the transmit line. Record the indication on voltmeter No. 3. The far-end crosstalk should be greater than 50 dB also.

7.16.8 BER Measurement Procedure.

a. Configure the test equipment as shown in figure 7-77.

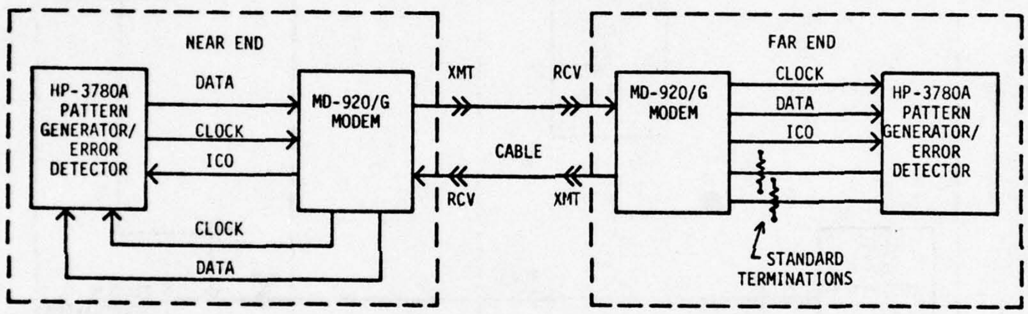


Figure 7-77. BER Test Setup.

b. Adjust the HP-3780A pattern generator/error detector controls as follows:

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZEROS ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	009
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^6
INPUT FORMAT	BINARY
DATA THRESHOLD	GND
CLOCK THRESHOLD	GND
CLOCK	EXT

c. Set the HP-3780A ZEROS thumbwheel switches to 000 and the block size to 1 x 10^8.

d. Once the test sets are in sync, press the START button on the HP-3780A and record the BER at the end of the test.

e. Disconnect the standard terminations and connect the transmit clock and data outputs to the appropriate inputs to the test MD-920/G or equivalent interface device at the far-end station.

f. At the near-end station, ensure that the HP-3780A is in bit sync with the far-end HP-3780A. Press the START button on the HP-3780A and record the BER at the far-end station. The BERs should be equal to the BERs obtained in step d above.

g. Normalize the system.

7.17 PERFORMANCE TESTING OF KY-3 SECURE VOICE TERMINAL.

7.17.1 Purpose. The purpose of these tests is to measure the performance of KY-3 secure voice terminals associated with automatic wideband secure voice communications.

7.17.2 Tests To Be Performed. The tests to be performed are as follows:

a. Signal-to-noise ratio.

b. Frequency response.

c. Frequency distortion.

d. Impulse noise.

e. Frequency translation.

f. Phase jitter.

7.17.3 Test Equipment. The following list of test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Oscilloscope	Tektronix 7603	1	029
Telephone test set	AN/USM-181	1	053
Distortion analyzer	HP-339A	1	004
Transmission impairment measuring set	HP-4940A	1	054

7.17.4 Classification. The test procedures and standards to be used in these measurements have national defense security classifications. Therefore, reference is only given to the applicable technical manual.

7.17.5 Signal-To-Noise Ratio. Perform this test pursuant to TM 11-5805-620-14, paragraph 8-2.

7.17.6 Frequency Response. (Refer to TM 11-5805-620-14.)

7.17.7 Frequency Distortion. Perform this test pursuant to TM 11-5805-620-14, paragraph 8-2.

7.17.8 Impulse Noise. Perform this test pursuant to TM 11-5805-620-14, paragraph 4a.

7.17.9 Frequency Translation. (Test reference not available.)

7.17.10 Phase Jitter. (Test reference not available.)

7.18 IMPAIRMENT LOSSES AS TRANSMISSION MEDIA ARE INCREASED AND/OR CONDITIONING EQUIPMENT IS ADDED.

7.18.1 Purpose. The purpose of this procedure is to measure the degradation in communications quality as transmission media are extended and conditioning equipment is added or incorporated into the circuit.

7.18.2 Test Equipment. A pattern generator/error detector, HP-3780A (code 018) or equivalent, is required to perform this test.

7.18.3 Circuits To Be Tested. The circuits to be tested by this procedure are as follows:

Switch/ subscriber	Type	Connected to	No. of circuits
Osan	SECORD	Seoul SECORD	1
		Taequ SECORD	1
		Yokota SECORD	1
		Kunsan SECORD	1
Seoul	SECORD	Osan SECORD	1
		Camp Casey subscriber	1
		Pentagon 758C	1
		Hawaii tandem switch	2
		Camp Red Cloud Subscriber	1
		Taegu	2
		Tango	2
Taegu	SECORD	Osan SECORD	1
		Hawaii tandem switch	1
		Seoul SECORD	2
		Tango SECORD	2
		Camp Zama SECORD	1
		Clark SECORD	1
		Kadena SECORD	1
		Chinhae subscriber	1

Switch/ subscriber	Type	Connected to	No. of circuits
Tango	SECORD	Taegu SECORD	2
		Seoul SECORD	2
		Hawaii tandem switch	1
Camp Red Cloud	TSEC/KY-3	Seoul SECORD	1
Camp Casey	TSEC/KY-3	Seoul SECORD	1
Chinhae	TSEC/KY-3	Taegu SECORD	1
Kunsan	SECORD	Osan SECORD	1
Tokyo	TSEC/KY-3	Yokota SECORD	1
Yokota	SECORD	Hawaii tandem switch	2
		Camp Zama SECORD	2
		Osan SECORD	1
		Yokosuka SECORD	1
		Kadena SECORD	1
		Tokyo subscriber	1
Camp Zama	SECORD	Yokota SECORD	2
		Hawaii tandem switch	1
		Taegu SECORD	1
		Yokosuka SECORD	1
		Atsugi subscriber	2
		Clark SECORD	1
Atsugi	TSEC/KY-3	Camp Zama SECORD	2
Yokosuka	SECORD	Camp Zama SECORD	1
		Yokota SECORD	1
Clark	SECORD	Hawaii tandem switch	2
		Diego Garcia subscriber	1
		Andersen SECORD	1
		Camp Zama SECORD	1
		Subic Bay sub-scriber	1
		Contingency	2
		Taegu	1

Switch/ subscriber	Type	Connected to	No. of circuits
Subic Bay	TSEC/KY-3	Clark SECORD	1
Depus D	SECORD	Hawaii tandem switch	1
		Andersen SECORD	1
Guantanamo	SECORD	Norfolk AN/FTC-31	1
Puerto Rico	SECORD	Norfolk AN/FTC-31	1
Pentagon (switch)	758C	Canal Zone AN/ FTC-31	2
		Hawaii tandem switch	4
		Elmendorf AN/FTC-31	2
		Seoul SECORD	1
		Offutt AN/FTC-31	2
		Ramstein AN/FTC-31	1
		London AN/FTC-31	1
		Naples SECORD	1
		Peterson Field AN/FTC-31	1
		Norfolk AN/FTC-31	2
		Casteau SECORD	1
		Heidelberg AN/ FTC-31	1
		Vaihingen AN/ FTC-31	1
Canal Zone	AN/FTC-31	Pentagon 758C	2
Heidelberg	AN/FTC-31	Worms SECORD	1
		Berlin 758C	1
		Ramstein AN/FTC-31	1
		Pentagon 758C	1
		London AN/FTC-31	1
Vaihingen	AN/FTC-31	Contingency	1
		Pentagon 758C	1
Berlin	758C	Heidelberg AN/ FTC-31	1
Worms	SECORD	Heidelberg AN/ FTC-31	1

Switch/ subscriber	Type	Connected to	No. of circuits
Ramstein	AN/FTC-31	Heidelberg AN/ FTC-31	1
		Pentagon 758C	1
		AF #2 SECORD	1
AF #2	SECORD	Ramstein AN/FTC-31	1
Casteau	SECORD	Pentagon 758C	1
Diego Garcia	TSEC/KY-3	Clark SECORD	1
Shemya	SECORD	Peterson Field AN/FTC-31	1
Andersen	SECORD	Hawaii tandem switch	1
		Depus D SECORD	1
		Clark SECORD	1
		H. E. Holt subscriber	1
Kadena	SECORD	Hawaii tandem switch	1
		Taegu SECORD	1
		Yokota SECORD	1
Woomera	TSEC/KY-3	Peterson Field AN/FTC-31	1
H. E. Holt	TSEC/KY-3	Anderson SECORD	1
Hawaii tandem switch		Pentagon 758C	4
		Offutt AN/FTC-31	2
		Peterson Field AN/FTC-31	2
Hawaii tandem Switch		Andersen SECORD	1
		Clark SECORD	2
		Yokota SECORD	2
		Seoul SECORD	2
		Kadena SECORD	1
		Depus D SECORD	1
		Taegu SECORD	1
		Tango SECORD	1
		Camp Zama SECORD	1
		Contingency	2

Switch/ subscriber	Type	Connected to	No. of circuits
Elmendorf	AN/FTC-31	Pentagon 758C	2
		Offutt AN/FTC-31	1
		Peterson Field AN/FTC-31	1
Peterson Field	AN/FTC-31	Elmendorf AN/FTC-31	1
		Pentagon 758C	1
		Hawaii tandem switch	2
		Offutt AN/FTC-31	1
		Shemya SECORD	1
		Woomera subscriber	1
Norfolk	AN/FTC-31	Iceland subscriber	1
		Lajes subscriber	2
		Holy Lock subscriber	1
		Brunswick, ME subscriber	1
		Cutler, ME subscriber	1
		Pentagon 758C	2
		Charleston, SC, subscriber	1
		Jacksonville, FL subscriber	1
		Guantanamo SECORD	1
		Puerto Rico SECORD	1
London	AN/FTC-31	Pentagon 758C	1
		Naples SECORD	1
		Rota subscriber	1
		Mildenhall SECORD	1
		Heidelberg AN/FTC-31	1
Naples	SECORD	London AN/FTC-31	1
		Pentagon 758C	1
Rota	TSEC/KY-3	London AN/FTC-31	1
Mildenhall	SECORD	London AN/FTC-31	1

Switch/ subscriber	Type	Connected to	No. of circuits
Offutt	AN/FTC-31	Elmendorf AN/ FTC-31	1
		Pentagon 758C	2
		Peterson Field AN/FTC-31	1
		Hawaii tandem switch	2
Charleston, SC	TSEC/KY-3	Norfolk AN/FTC-31	1
Jacksonville, FL	TSEC/KY-3	Norfolk AN/FTC-31	1
Brunswick, ME	TSEC/KY-3	Norfolk AN/FTC-31	1
Cutler, ME	TSEC/KY-3	Norfolk AN/FTC-31	1
Iceland	TSEC/KY-3	Norfolk AN/FTC-31	1
Holy Loch	TSEC/KY-3	Norfolk AN/FTC-31	1
Lajes	TSEC/KY-3	Norfolk AN/FTC-31	2

Procedure.

a. Note that the test configurations contained herein may not reflect the actual equipment or assignment configurations and are being used only as typical configurations for discussion purposes.

b. At points where the circuit interfaces and interconnects with other users, such as at microwave radio or cable systems, loopback testing may not be accomplished because it may disrupt other circuits.

c. Configure the test equipment as shown in figure 7-78 and allow for a 15-minute warmup and stabilization period.

d. Adjust the controls on the HP-3780A pattern generator/ error detector as follows:

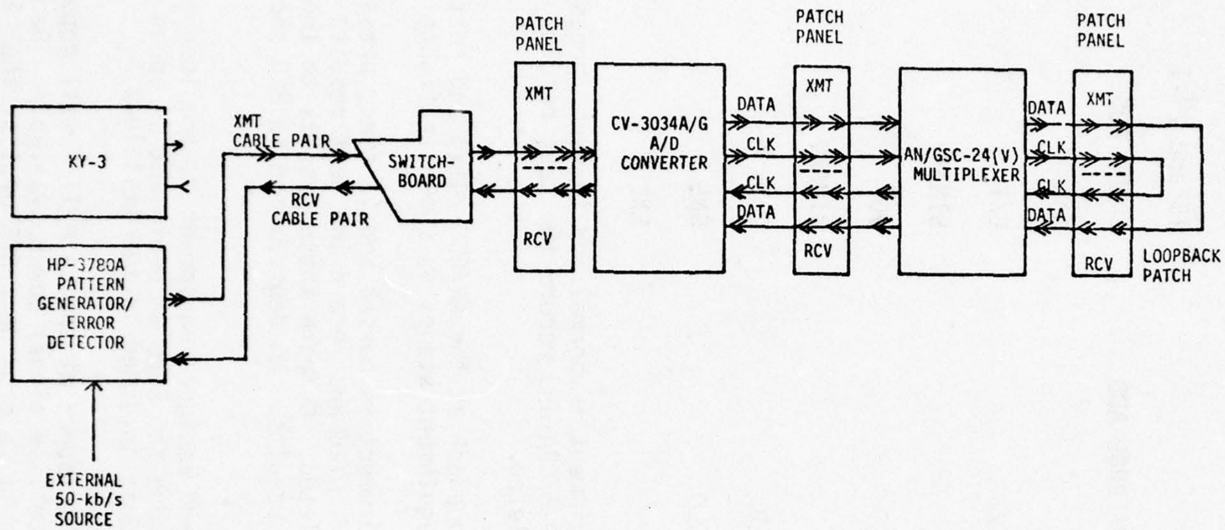


Figure 7-78. Impairment Loss Measurement (Near-End AN/GSC-24(V) Loopback).

Control	Setting
OUTPUT FORMAT	NRZ and CLOCK
WORD	15 and 2^n-1
ZERO ADD/NORM/ERROR ADD	ERROR ADD
ZEROS	000
OFFSET/NORM/EXT	EXT
MEASUREMENT	BINARY
BER COUNT	10^8
INPUT FORMAT	BINARY
DATA THRESHOLD	200
CLOCK THRESHOLD	GND
CLOCK	EXT

e. After all equipment is normal and in sync, press the START button on the HP-3780A and record the test results after measurements are completed.

f. Remove the loopback at the AN/GSC-24(V) and perform a loopback at the next equipment stage, as shown in figure 7-79.

g. After all equipment is normal and in sync, press the START button on the HP-3780A and record the test results after measurements are completed. Compare these results to the previously recorded test results. No degradation in BER should be noted.

h. Continue to add assigned equipment to the loopback test configuration and measure the BERs as equipment is added until the distant CV-3034A/G is included in the test loop.

i. Note that BERs looped at the satellite will depend upon the amount of satellite signal power available. Generally, enough power is available to provide a BER of less than 1 x 10-7; therefore, no impairment to BER should be apparent.

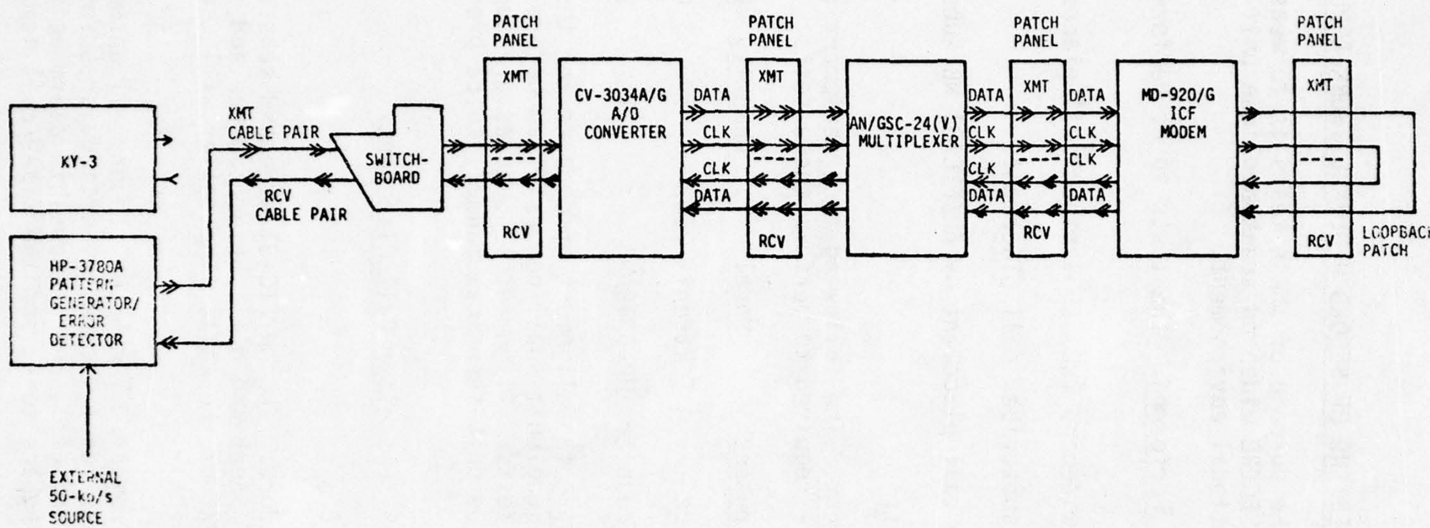


Figure 7-79. Impairment Loss Measurement (Near-End MD-920/G Loopback).

7.19 PERFORMANCE TESTING OF SECORD WIDEBAND TRUNK APPLIQUE UNIT.

7.19.1 Purpose. The purpose of these tests is to measure the performance of the SECORD wideband trunk applique unit when installed in an operational environment.

7.19.2 Tests To Be Performed. The tests to be performed are as follows:

a. AN/FTC-31 wideband (WB) subscriber call placement.

b. SECORD WB subscriber call placement.

c. Preemption call placement by AN/FTC-31 WB subscriber.

d. Preempt out.

7.19.3 Test Equipment. The following test equipment or equivalent instruments are required to perform these tests:

Test instrument	Model	Quantity	Code
Oscilloscope	Tektronix 7603	1	029
Frequency counter	HP-5340A	1	013

7.19.4 PREALIGNMENT. The alignment procedures for the SECORD wideband trunk applique unit shall be performed before the start of the operational tests. Alignment procedures are supplied in the wideband applique unit technical manual, to be provided with the unit.

7.19.5 AN/FTC-31 WB Subscriber Call Placement.

a. Step No. 1.

(1) Procedure. The AN/FTC-31 wideband subscriber (WB sub) "A" will go off hook and dial the precedence and the 4-digit number (P-XXXX) of the call. The caller will use a routine precedence for this call.

(2) Requirement. The SECORD trunk call answer (TRK C/A) lamp illuminates for 1 second and extinguishes for 1 second (1 second on, 1 second off), and the audible alarm actuates. Sub A receives a ringback tone, and the KYX-9 call lamp illuminates.

b. Step No. 2.

(1) Procedure. The SECORD operator places the SELECT switch to the TRK position and depresses the trunk C/A button and answers the call on KYX-9. (NOTE: Perform this procedure with the handset on hook and off hook.)

(2) Requirement. The audible alarm stops. The trunk call/answer remains on. The KYX-9 sync light indicates crypto sync, and the operator can talk to sub A.

c. Step No. 3.

(1) Procedure. The sub C operator obtains address information from sub A and tells sub A to hold. The KYX-9 is left off hook.

(2) Requirement. The operator's conversation with sub A is in the secure mode. The KYX-9 sync lamp is steady on and the SECORD trunk secure lamp is on.

d. Step No. 4.

(1) Procedure. The operator places the SELECT switch to the SUB position, then depresses sub C's call/answer button and depresses the SUB RING pushbutton.

(2) Requirement. The ring tone signals sub C who goes off hook and talks to the operator in the clear mode. Sub C's C/A lamp lights when sub C goes off hook.

e. Step No. 5.

(1) Procedure. The operator informs sub C of the call and tells sub C to go secure.

(2) Requirement. The sub C operator lifts the white plunger on the KYX-9; the sync lamp will blink because synchronization is not present.

f. Step No. 6.

(1) Procedure. The operator patches sub C to the WB trunk that sub A's call came in on, then places the KYX-9 on hook and depresses the SUB and TRK CLEAR buttons.

(2) Requirement. Secure conversation between sub A and sub C occurs. Both sub A and sub C sync lamps are steady. Both C/A lamps are steady and the trunk secure lamp is on.

g. Step No. 7.

(1) Procedure. The conversation ends. Record comments of sub A and sub C.

(2) Requirement. Both C/A lamps will extinguish and a 3-beep/second audible alarm sounds.

h. Step No. 8.

(1) Procedure. Prior to the operator removing the patchcord, have sub B dial the SECORD using a routine precedence.

(2) Requirement. Sub B is unable to call the SECORD, because it has not restored 2600 Hz to the AN/FTC-31 switch.

i. Step No. 9.

(1) Procedure. Operator removes the patchcord.

(2) Requirement. The call circuit between sub A and sub C is broken. A 2600-Hz tone appears on the WB trunk to the AN/FTC-31 switch. NOTE: At the patch and test facility (PTF), place an oscilloscope or frequency counter on the circuit to ensure that the 2600-Hz tone is present.

7.19.6 SECORD WB Subscriber Call Placement.

a. Step No. 1.

(1) Procedure. Sub C (wideband subscriber) goes off hook.

(2) Requirement. The subscriber C/A lamp lights and the audible alarm sounds.

b. Step No. 2.

(1) Procedure. The SECORD operator sets the SELECT switch to SUB and depresses the (lighted) C/A switch indicator.

(2) Requirement. The audible alarm stops.

c. Step No. 3.

(1) Procedure. The operator obtains address information (sub B off AN/FTC-31 switch) and tells sub C to go secure and hold.

(2) Requirement. Sub C's KYX-9 sync lamp blinks because no crypto sync is present.

d. Step No. 4.

(1) Procedure. The operator depresses the WB trunk C/A button and goes off hook with the KYX-9.

(2) Requirement. The KYX-9 call lamp lights and a dial tone is heard.

e. Step No. 5.

(1) Procedure. The operator dials sub B using a routine precedence.

(2) Requirement. A ringback tone is received. When sub B answers, the tone will stop and the C/A lamp comes on steady.

f. Step No. 6.

(1) Procedure. The operator informs sub B of the call and asks sub B to stand by.

(2) Requirement. The call between the operator and sub B is secure, and the sync lamps on both KYX-9's are on steady. The trunk secure lamp is on at the SECORD.

g. Step No. 7.

(1) Procedure. The operator will patch sub C to a WB trunk and depress the SUB and TRK CLEAR pushbuttons. The KYX-9 is then placed on hook.

(2) Requirement. The secure call between sub B and sub C occurs.

h. Step No. 8.

(1) Procedure. The call terminates. The operator records call comments. (NOTE: A feature may be added to the applique which will also ring an audible alarm when this happens.)

(2) Requirement. The trunk and sub C/A lamps extinguish.

i. Step No. 9.

(1) Procedure. Prior to removing the patchcord, have sub A dial the SECORD using a routine precedence. (NOTE: If this step occurs after the original call, no level of precedence should get the call through.)

(2) Requirement. Sub A is unable to call the SECORD when using the same precedence as the established call.

j. Step No. 10.

(1) Procedure. The operator removes the patchcord.

(2) Requirement. The call circuit between sub B and sub C will be broken.

7.19.7 Preemption Call Placement by AN/FTC-31 WB Subscriber.

a. Step No. 1.

(1) Procedure. Set up a routine precedence call between sub A off the AN/FTC-31 switch and sub C off a SECORD.

(2) Requirement. Sub A and sub C should be conversing in the secure mode. Trunk and sub C/As are steady on.

b. Step No. 2.

(1) Procedure. AN/FTC-31 sub B calls the SECORD sub C with a higher precedence.

(2) Requirement. The AN/FTC-31 switch will automatically preempt sub A (internally to the switch) and send a preempt tone to the applique unit. The applique unit will detect the preempt tone and cause the trunk preempt lamp to illuminate. Sub A hears the AN/FTC-31 preempt tones; sub C hears the applique preempt tones and goes on hook, or until the operator removes the patchcord.

c. Step No. 3.

(1) Procedure. The operator removes the patchcord to sub C and depresses the SUB and TRK CLEAR switches.

(2) Requirement. The AN/FTC-31 switch detects an on-hook condition at the SECORD and connects sub B to the trunk and the ring to the applique. The trunk C/A lamp begins flashing and the audible alarm sounds.

d. Step No. 4.

(1) Procedure. The operator puts the SELECT switch in the TRK position and then depresses the trunk C/A button and answers sub B on KYX-9. Sub B is calling sub D off of the SECORD.

(2) Requirement. The trunk C/A lamp is steady on and the audible alarm stops. Sub B and the operator converse in the secure mode; the steady sync lamp illuminates on both KYX-9s.

e. Step No. 5.

(1) Procedure. The operator tells sub B to hold, sets the SELECT switch to SUB, and depresses the C/A button for sub D; then, the operator depresses the SUB RING pushbutton with the KYX-9 off hook.

(2) Requirement. The operator hears a ringback tone from sub D. When sub D answers, the C/A button lights and the ringback tone ends. The operator's KYX-9 sync lamp is steady on.

f. Step No. 6.

(1) Procedure. The operator tells sub D to go secure and hold. The operator then patches (WB SUB jack to WB TRK jack) sub B to sub D.

(2) Requirement. Sub B and sub D can converse in the secure mode. Their KYX-9 sync lamps are steady on.

g. Step No. 7.

(1) Procedure. The operator depresses the SUB and TRK CLEAR pushbuttons and places the KYX-9 and SECORD jackset on hook.

(2) Requirement. The operator's KYX-9 sync lamp goes off. The C/A lamps of the trunk and sub D are steady on.

h. Step No. 8.

(1) Procedure. The call ends and the operator records the call comments.

(2) Requirement. The C/A lamps extinguish and the operator removes the patchcord.

7.19.8 Preempt Out.

a. Step No. 1.

(1) Procedure. Set up a routine precedence call between subscribers B and D in accordance with previous test procedures.

(2) Requirement. Sub B and sub D should be conversing in the secure mode. The KYX-9 sync lamps and TRK and SUB SECURE lamps are steady on.

b. Step No. 2.

(1) Procedure. Sub C at the SECORD requests a call to the AN/FTC-31 switch sub at a higher precedence than the established call.

(2) Requirement. Sub C's C/A lamp lights and the audible alarm begins.

c. Step No. 3.

(1) Procedure. The operator depresses the trunk preempt switch.

(2) Requirement. The established call terminates. Sub B may hear AN/FTC-31 preempt tones; sub D hears applique preempt tones. Sub B and sub D go on hook. The trunk preempt lamp comes on.

d. Step No. 4.

(1) Procedure. The operator removes the patchcord for the sub B and sub D call; the operator depresses the SUB and TRK CLEAR switches.

(2) Requirement. The sub C/A lamp begins flashing.

e. Step No. 5.

(1) Procedure. The operator puts the SELECT switch in SUB, depresses the sub C/A button, and answers sub C on the SECORD. Sub C is calling sub B off the AN/FTC-31 switch. The precedence level must be determined.

(2) Requirement. The audible alarm stops. The sub C/A lamp is steady on. Sub C and the operator talk in the clear mode.

f. Step No. 6.

(1) Procedure. The operator tells sub C to go secure and hold. The operator puts the SELECT switch in TRK and depresses the trunk C/A button. The operator then goes off hook with the KYX-9 and dials sub B.

(2) Requirement. The operator hears a ringback tone from sub B. When sub B answers, the C/A button lights, the ringback tone stops, and the operator's KYX-9 sync lamp is steady on. The operator and sub B converse in the secure mode.

g. Step No. 7.

(1) Procedure. The operator tells sub B to hold, then patches the call for sub B and sub C. The operator then depresses the SUB and TRK CLEAR pushbuttons and places the KYX-9 and jackset on hook.

(2) Requirement. C/A lamps extinguish and the operator removes the patchcord.

SECTION 8. COMPLETION CERTIFICATION

8.1 GENERAL. The results of the QA inspections and acceptance tests specified in sections 6 and 7 will be documented on-site by the QAR/test director using USACEEIA FM 98-R, Technical Acceptance Recommendation (figure 8-1). The purpose of this technical document is to record the significant project information to include the scope of the effort, results and conclusions of the requisite inspections and tests, exceptions to the technical requirements, and recommendations regarding acceptance with or without exceptions or rejection of the work effort. The Technical Acceptance Recommendation (TAR) also allows other participants to indicate agreement or disagreement with the inspection and test assessments, and for the user to state a willingness to technically accept the installed system.

8.2 DISTRIBUTION. A copy of the TAR will be provided to the signing participants and the operating agency. The original copy will be maintained in the test agency project files, but copies will be reproduced and included as part of the test report.

8.3 WAIVERS. Waivers to include command approvals for individual installations will be recorded in the TAR and copies attached for the purpose of clarifying deviations from this SEIP and the individual engineering installation package (EIP).

8.4 TAR PREPARATION INSTRUCTIONS

a. Entries on the data sheets are to be typed whenever possible to ensure legibility and provide a quality, fully legible product when reproduced. If a typewriter is not available, the forms may be completed by printing with black ink in block letters to ensure legibility. The instructions for completion of this form follow on a block-by-block basis.

b. Pages are to be sequentially numbered to show both the individual page number and the total number of pages constituting the completed TAR. Additionally, each page will be identified by the date, project, and contract number in the appropriate blocks.

c. Instructions for completion of the TAR are delineated in the following subparagraphs and will be completed in accordance with these instructions:

(1) DATE: Enter the day, month, and year of completion for this action (e.g., 1/1/79 as the first day of the first month of 1979).

(2) PROJECT/CONTRACT NUMBER: Enter the appropriate project or contract number. If this is a subproject or part of a subproject, provide all necessary information (i.e., IIP milestone number(s) and subproject number(s), as well as subdivision(s) to same).

(3) TITLE: Enter the project name or title.

(4) LOCATION: Enter the geographic location where the project was installed.

(5) FACILITY: Enter the name of the facility and other pertinent identifying information.

(6) TEST DIRECTOR: Enter the name, title, and grade of the test director or QAR assigned to this project.

(7) OPERATING AGENCY: Enter the name, symbol, and complete mailing address of the organization having O&M responsibility for this project, system, or equipment installation.

(8) ENGINEERING AGENCY: Enter the name, symbol, and complete mailing address of the organization having engineering cognizance and responsibility.

(9) INSTALLATION AGENCY: Enter the name, symbol, and complete mailing address of the organization having been tasked to install the TAR materiel.

(10) TESTING AGENCY: Enter the name, symbol, and complete mailing address of the QA and testing organization tasked for this project.

(11) PROJECT DESCRIPTION: Enter a brief and concise description of the project to which the TAR applies.

(12) MAJOR EQUIPMENT INSTALLED/RELOCATED: List the major items of equipment installed or relocated in accordance with the project requirements. Enter the BOM line item number, materiel description, assigned part number or National Stock Number, and the quantity of each major item.

(13) DOCUMENTATION: Enter the document identification (i.e., drawing number, technical manual number, etc.), title, and the quantity of each document provided to the operating unit as part of the project.

AD-A069 738 ARMY COMMUNICATIONS COMMAND FORT HUACHUCA AZ F/G 17/2

STANDARD ENGINEERING INSTALLATION PACKAGE. WIDEBAND SECURE VOIC--ETC(U)

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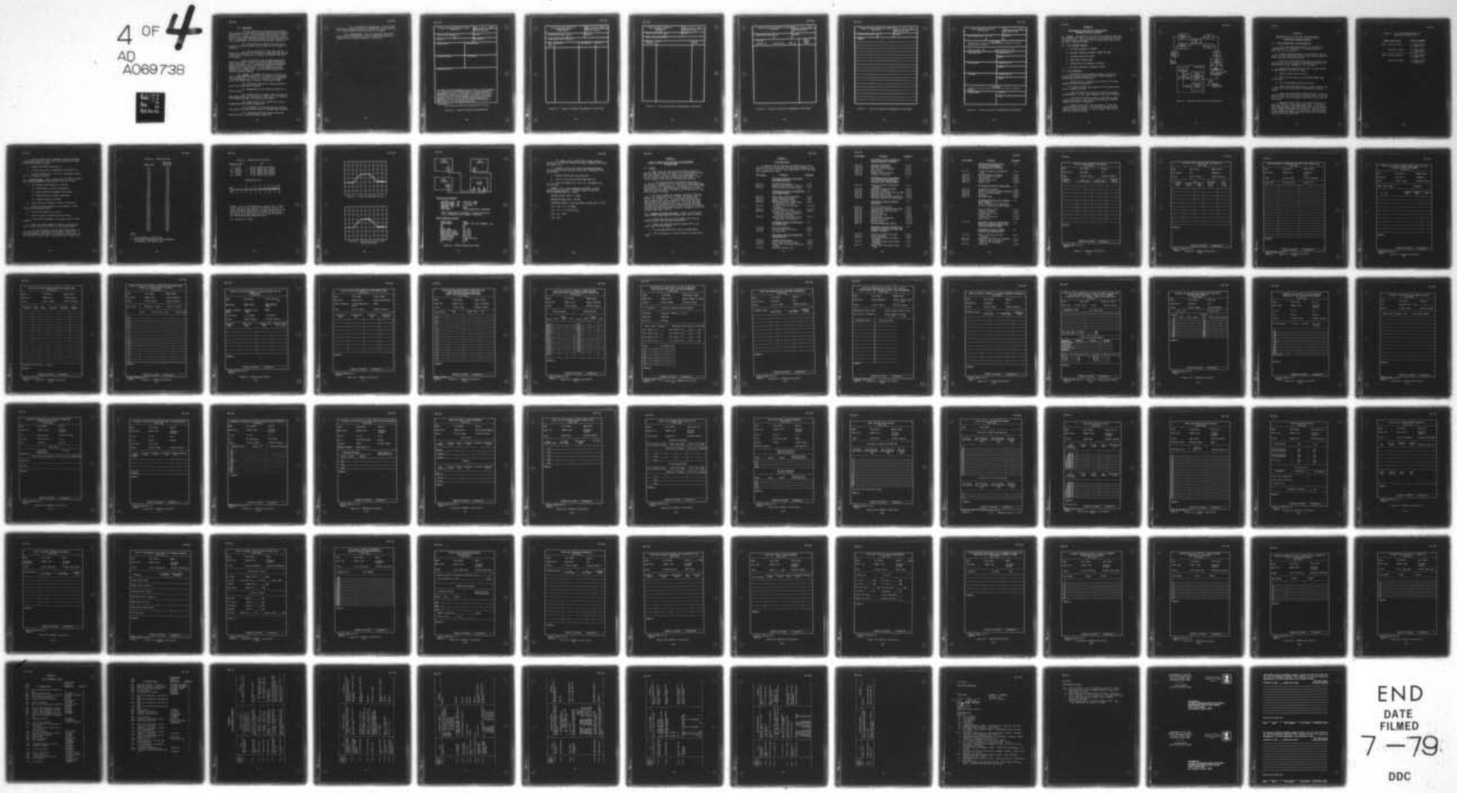

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(14) EXCEPTIONS:

(a) Upon completion of installation and testing, any exceptions to the project requirements that require corrective action will be listed. Include complete identification of each missing item. Exceptions must be based on the specified requirements of the project, supportable through the test results or other valid documentation, fully described, and precisely identified.

(b) The appropriate exception block must be annotated, and separate sheets should be used for each category of exception.

(c) The test director will also enter the suggested action agency for each exception, recognizing that the test director may not always be in a position to determine the final action agency.

(d) For facilities that are becoming partially operational, identify installation agency actions remaining for project completion. In this situation, the Materiel Acceptance Record will show the tests that have been made, but will be identified as a partial record. A final Materiel Acceptance Record will be prepared after installation and testing of all remaining project equipment.

(15) REMARKS: The REMARKS section may be used to provide any additional information on or in support of a recommendation, commendation, or criticism in relation to the project installation, engineering, or testing. Entries may include:

(a) Shortcomings that do not require corrective action (not considered an exception).

(b) Recommendations for improving projects of a similar nature.

(c) Identification of support items that have not been accomplished, and a description of any activity in progress by the operating agency to satisfy the requirement.

(d) A description of test results with the performing agency and date(s) accomplished.

(e) A statement to the effect that the installation agency will forward final "as-built" drawings when completed.

(f) A description of the ac power system with identification of source and backup capability.

(g) A statement to indicate that a list of excess material was provided the operating command for final disposition or to identify material that was excess to the project.

(16) CERTIFICATION: Enter the signatures and certification that the project was installed, tested, and accepted for operation with or without exceptions as applicable.

TECHNICAL ACCEPTANCE RECOMMENDATION (SUMMARY) (CCCR 702-2)		PAGE 1 OF 6 PAGES DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE	LOCATION
FACILITY		TEST DIRECTOR
OPERATING AGENCY		ENGINEERING AGENCY
INSTALLATION AGENCY		TESTING AGENCY
PROJECT DESCRIPTION **This Technical Acceptance Recommendation is executed by the on-site representatives of the installation, test, and operating agencies. It does not constitute official acceptance of the project but does certify that the MAJOR ITEMS INSTALLED AND DOCUMENTATION PROVIDED are as stated herein. This document further certifies that the project has been installed and performs satisfactorily in accordance with the requirements listed under REFERENCES, except as noted under EXCEPTIONS and REMARKS. Upon execution of this Technical Acceptance Recommendation, USACEEIA considers this project complete, except for such follow-on action as may be necessary to clear the EXCEPTIONS stated herein.**		

USACEEIA FM 98-R
1 Jan 79 Replaces HQ USACEEIA CCC-TED-QA FM 98 which is obsolete

Figure 8-1. Technical Acceptance Recommendation.

TECHNICAL ACCEPTANCE RECOMMENDATION (INSTALLED EQUIPMENT) (CCCR 702-2)			PAGE 2 OF 6 PAGES DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE		LOCATION
MAJOR EQUIPMENT INSTALLED/RELOCATED			
BOM ITEM NO.	DESCRIPTION	PART NUMBER/FSN	QUANTITY

Figure 8-1. Technical Acceptance Recommendation (Continued).

TECHNICAL ACCEPTANCE RECOMMENDATION (DOCUMENTATION) (CCCR 702-2)		PAGE 3 OF 6 PAGES
		DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE	LOCATION
PROJECT DOCUMENTATION PROVIDED		

REFERENCE DOCUMENTATION	TITLE	NO. OF COPIES

Figure 8-1. Technical Acceptance Recommendation (Continued).

TECHNICAL ACCEPTANCE RECOMMENDATION (EXCEPTIONS) (CCCR 702-2)			PAGE 4 OF 6 PAGES DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE		LOCATION
EXCEPTIONS ENGINEERING ☐ INSTALLATION ☐ OTHER ☐			SUGGESTED ACTION AGENCY

Figure 8-1. Technical Acceptance Recommendation (Continued).

TECHNICAL ACCEPTANCE RECOMMENDATIONS (REMARKS) (CCCR 702-2)		PAGE 5 OF 6 PAGES DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE	LOCATION
REMARKS:		

Figure 8-1. Technical Acceptance Recommendation (Continued).

TECHNICAL ACCEPTANCE RECOMMENDATION (CERTIFICATION)		PAGE 6 OF 6 PAGES
		DATE (DAY, MO, YEAR)
PROJECT/CONTRACT NUMBER	TITLE	LOCATION

CERTIFICATION

Acceptance tests and Quality Assurance Inspections are complete for equipment installed under this project.

WITHOUT EXCEPTIONS ☐ WITH NOTED EXCEPTIONS ☐

INSTALLATION AGENCY	SIGNATURE AND TITLE
	PRINTED
OPERATING AGENCY	SIGNATURE AND TITLE
	PRINTED
TEST AGENCY	SIGNATURE AND TITLE
	PRINTED

ACCEPTANCE

Equipment herein certified successfully installed and tested, is accepted for operation.

OPERATING COMMAND	SIGNATURE
	TITLE

Figure 8-1. Technical Acceptance Recommendation (Continued).

APPENDIX A

MEASUREMENTS OF RECEIVER C/kT RATIO USING A FREQUENCY SELECTIVE VOLTMETER

A-1. GENERAL. The purpose of this test is to provide a technique for measuring C/kT ratio. The accuracy of this technique is ±1 dB. This measurement is applicable to CW or unmodulated radio frequencies and is resolved to dB/Hz.

A-2. TEST EQUIPMENT REQUIRED.

a. VHF signal generator, HP-8640B.

b. Frequency selective voltmeter (FSVM), HP-312D.

c. Frequency counter, HP-5340A.

d. Power meter, Boonton 42B.

e. VHF/UHF mixer (0.2-500 MHz), HP-10514A.

f. Variable attenuator, HP-355B or HP-355C.

A-3. TEST PROCEDURES.

a. Configure the test equipment as shown in figure A-1. Ensure that the down converter is tuned to the frequency of the selected carrier to be measured.

b. Energize the test equipment and allow for a 15-minute warmup and stabilization period.

c. Calibrate the VHF signal generator for an output power level of 0 dBm at 71.0 MHz.

d. Tune the FSVM to 1 MHz and set to the 3.1-kHz resolution bandwidth. Set the input impedance to 600 ohms terminated.

e. Fine tune the frequency control of the FSVM to obtain a peak indication at 1 MHz. Record the indication on the appropriate data sheet in appendix D.

f. Remove the carrier or tune the FSVM to 1.5 MHz and record the meter indication. The difference between the FSVM reading in dB plus 36.91 dB (3.1 kHz) is equal to the receive C/kT ratio defined in dB/Hz.

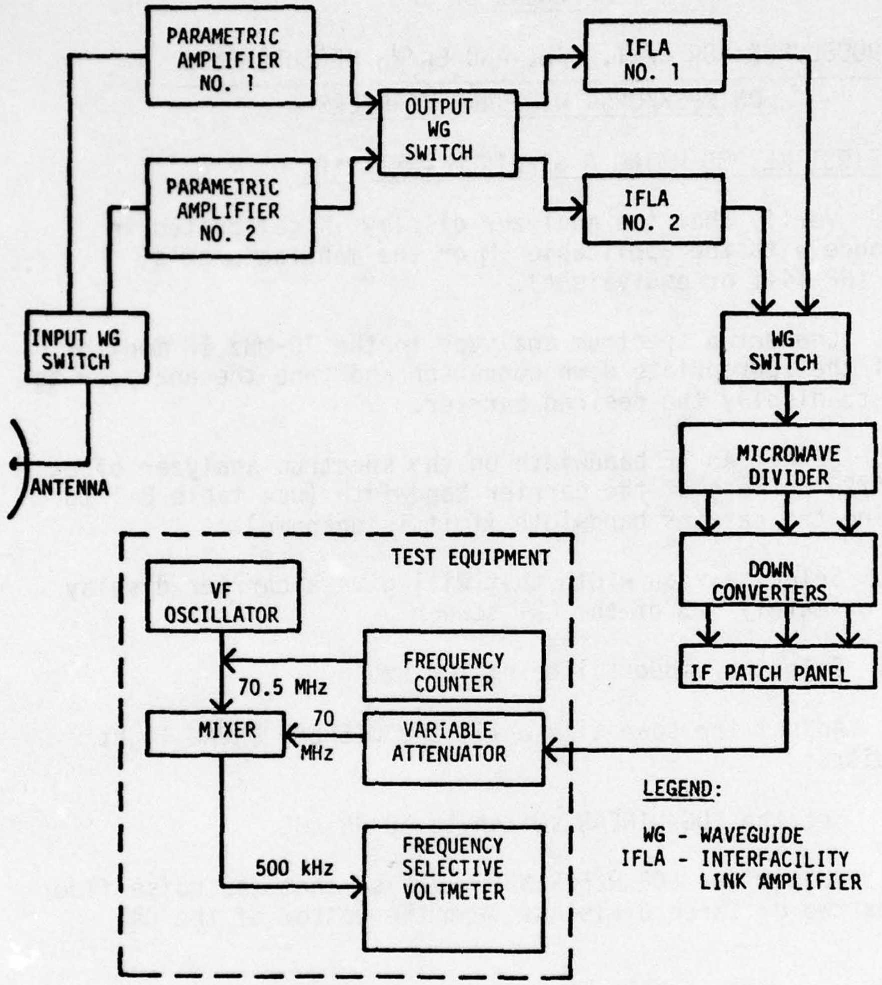


Figure A-1. Receiver C/kT Ratio Test Configuration.

APPENDIX B

PROCEDURES FOR C/kT, C/N, AND E_b/N_o MEASUREMENTS ON BPSK/QPSK WIDEBAND CARRIERS

B-1. FIRST METHOD USING A SPECTRUM ANALYZER.

a. Verify that the analyzer display is calibrated in accordance with the applicable TM or the manufacturer's manual (HP-141T or equivalent).

b. Connect a spectrum analyzer to the 70-MHz IF monitor port of the appropriate down converter and tune the analyzer to 70 MHz to display the desired carrier.

c. Select an IF bandwidth on the spectrum analyzer of at least 1/20 or less of the carrier bandwidth (use table B-1 to determine the carrier bandwidth if it is unknown).

d. Select a scan width that will give a carrier display of approximately 1/3 of the CRT screen.

e. Select a video filter of 100 Hz.

f. Adjust the scan time until the DISPLAY UNCAL light extinguishes.

g. Set the LOG/LINEAR switch to 10 dB LOG.

h. Adjust the LOG REFERENCE LEVEL so that the noise floor is about two or three divisions from the bottom of the CRT screen.

i. Adjust the LOG REFERENCE LINEAR SENSITIVITY vernier so that the noise floor is on one of the scale lines. If the noise floor is uneven, use the average of the noise on each side of the carrier.

j. Remove the signal input to the spectrum analyzer and note the difference in the noise floor level. If the noise floor does not drop by more than 10 dB, remove 10 dB from the INPUT ATTENUATION and check the difference in the noise floor again; repeat if necessary until more than a 10-dB difference is seen between the signal input noise floor and the spectrum analyzer front-end noise floor.

Table B-1. Carrier Bandwidth (BW) Versus Data Rate or Symbol Rate

Modem configuration		Carrier bandwidth
QPSK:	No error coding	1 x data rate or 2 x symbol rate
	With error coding	2 x data rate or 2 x symbol rate
BPSK:	No error coding	2 x data rate or 2 x symbol rate
	With error coding	4 x data rate or 2 x symbol rate

k. With the signal input reconnected, note the difference in dB between the peak of the carrier level and the noise level. Record the difference as C+N/N.

l. Convert the C+N/N using table B-2.

m. Find 10 x log (carrier bandwidth/2) using table B-3.

n. Using the formula C/kT = C/N + 10 x log (BW/2), compute C/kT. See figures B-1 and B-2.

B-2. ALTERNATE METHOD. Using a wave analyzer (HP-312A or equivalent) without removing the PSK modulation from the carrier.

a. The following test equipment is required:

(1) Wave analyzer, HP-312A or equivalent.

(2) Signal generator, HP-8640B or equivalent.

(3) VHF/UHF mixer, HP-10514A or equivalent.

(4) Frequency counter, HP-5340A.

b. Connect the test equipment as shown in figure B-3.

c. Adjust the signal generator for an output of 70 MHz ±100 Hz at approximately 0 dBm.

d. Tune the wave analyzer to 10 kHz.

e. Record the level in dBm on the wave analyzer.

f. If the carrier bandwidth is not known, derive it from table B-1.

g. Adjust the signal generator frequency to measure the noise on either side of the carrier in the following manner:

(1) For the noise on the low side of the carrier, set the signal generator frequency to 70 MHz minus one-half the carrier bandwidth. Tune around this frequency a few kHz to find the noise floor (lowest level). Record this level in dBm as N_1.

Table B-2. C+N/N Versus C/N

C+N/N in dB	Equivalent C/N in dB
3.0	0.0
3.5	0.9
4.0	1.8
4.5	2.6
5.0	3.3
5.5	4.1
6.0	4.8
6.5	5.4
7.0	6.0
7.5	6.6
8.0	7.2
8.5	7.8
9.0	8.4
9.5	9.0
10.0	9.5
10.5	10.1
11.0	10.7
11.5	11.2
12.0	11.7
12.5	12.2
13.0	12.8
13.5	13.3
14.0	13.8
14.5	14.4
15.0	14.9
15.5	15.4
16.0	15.9
16.5	16.4
17.0	16.9
17.5	17.4
18.0	17.9
18.5	18.4
19.0	18.9
19.5	19.4
20.0	20.0

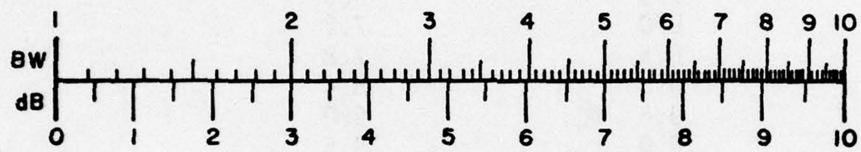
NOTES:

1. Values rounded to nearest tenth.
2. For C+N/N of 20 dB and above, the difference is negligible (less than 0.1 dB).

Table B-3. Bandwidth Versus dB Ratio

Bandwidth (BW)		dB
1 - 10 kHz	=	30 dB + BW/dB scale reading
10 - 100 kHz	=	40 dB + BW/dB scale reading
100 - 1000 kHz	=	50 dB + BW/dB scale reading
1 - 10 MHz	=	60 dB + BW/dB scale reading
10 - 100 MHz	=	70 dB + BW/dB scale reading

Bandwidth/dB scale



EXAMPLE: For a carrier bandwidth of 126 kHz, BW/2 = 63 kHz. Since 63 kHz is in the range of 10 to 100 kHz, 63 kHz = 40 dB plus the BW/dB scale reading. Consider the BW side of the scale to be 10 to 100 kHz and find 63 kHz on the BW scale. Look across on the dB scale and you will find the value of 8 dB. Now the two values added give 48 dB.

10 x log (63 kHz) = 48 dB.

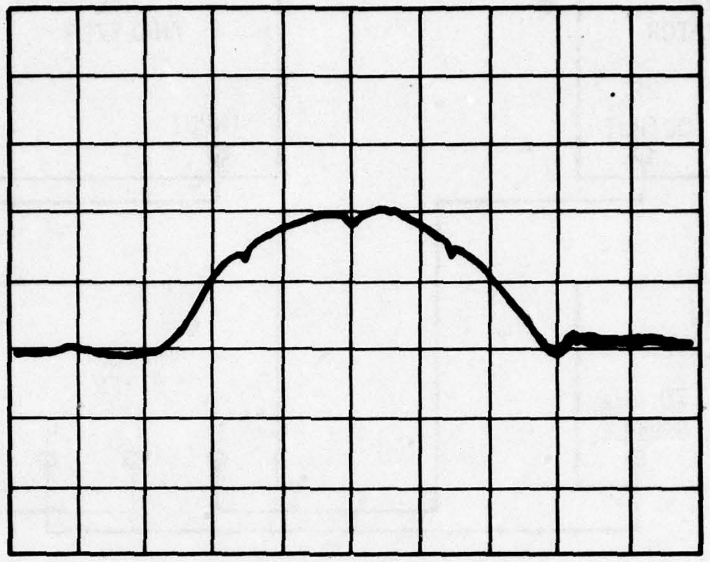


Figure B-1. Normal PSK Modulated Carrier.

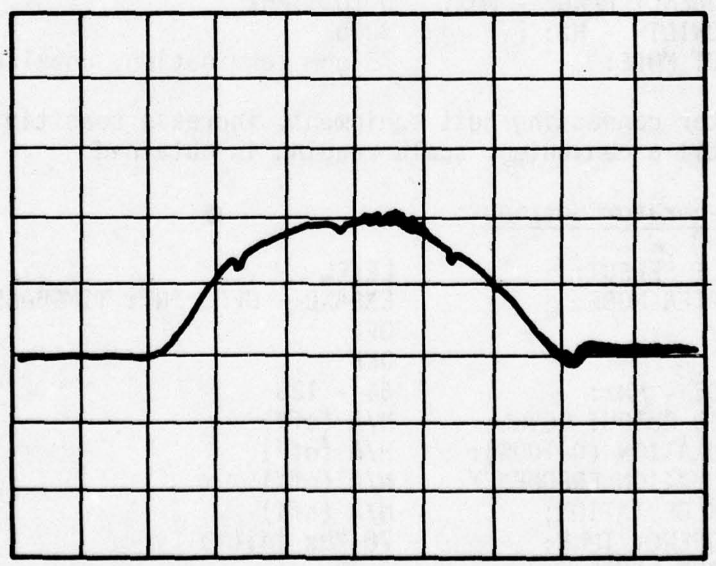
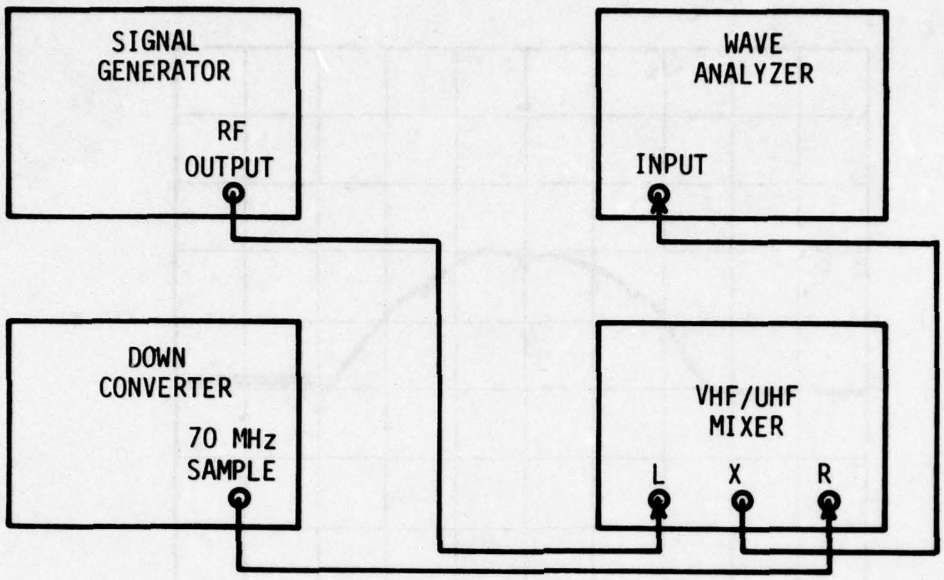


Figure B-2. PSK Modulated Carrier with IM/UC Interference.



Wave Analyzer Settings:

REFERENCE LEVEL - dBm:	Initially 0 dBm*
AMPLITUDE RANGE - dB:	Initially 0 dBm
FREQUENCY RANGE - MHz:	0 to 1 MHz
BANDWIDTH - Hz:	3000
INPUT MODE:	75-ohm termination, unbalanced

*After connecting test equipment, increase sensitivity until a convenient scale reading is obtained.

Signal Generator Settings:

SCALE SELECT:	LEVEL
COUNTER MODE:	EXPAND - OFF, INT; TIMEBASE - CAL
AM:	OFF
FM:	OFF
RANGE - MHz:	64 - 128
AUDIO OUTPUT LEVEL:	N/A (off)
MODULATION (0-100%):	N/A (off)
MODULATION FREQUENCY:	N/A (off)
PEAK DEVIATION:	N/A (off)
FREQUENCY TUNE:	70 MHz initially
OUTPUT LEVEL:	0 dBm
RF:	ON

Figure B-3. Alternate Method Test Setup.

(2) Repeat step (1) above using a signal generator frequency of 70 MHz plus one-half the carrier bandwidth and record this level as N_2.

h. Average N_1 and N_2 and record the difference between the average noise level and the carrier level (recorded in step 2e) as C+N/N.

i. Convert C+N/N to C/N using table B-2.

j. Find 10 x log (carrier BW/2) using table B-3.

k. Using the formula C/kT = C/N + 10 x log (BW/2), compute the C/kT.

EXAMPLE: For a carrier modulated with QPSK, no error coding, and the data rate = 1.55 Mb/s, table B-1 gives the carrier bandwidth (BW) of 1.55 MHz.

Measured carrier level = -32 dBm.

Measured average noise = -40 dBm.

Difference (C+N/N) = 8 dB, and table B-2 gives C/N = 7.2 dB.

C/kT = C/N + 10 x log (BW/2)

C/kT = 7.2 + 10 x log (775 kHz)

C/kT = 7.2 + 58.9

C/kT = 66.1.

APPENDIX C

GENERAL INFORMATION AND PROCEDURE FOR MEASUREMENTS OF ALPHA FLUNK

C-1. GENERAL

a. Alpha flunk is a term used to describe the count of data bits that are below a set quality in a given number of total bits (for example, 5 bits per 10,000, usually expressed as 5×10^{-4}, which is derived by dividing the total number of bits into the number of bits that were below the set quality).

b. In a PSK modem (MD-921/G or MD-1002/G) during any 1-bit period, an integrater will be charging to a value proportional to the quality of the incoming bit. At the end of each bit period, the integrater will "dump" two types of information: (1) the polarity of the bit, and (2) the quality of the received bit (the level to which it charged).

c. The level to which the integrater charged is quantized into a 2-bit binary word (that is, 0-25% = 00, 26-50% = 01, 51-75% = 10, 76-100% = 11). It is the most significant bit of the two quality bits that is counted as alpha flunk (one count each time the most significant bit = 0). It can be seen that, for each count, the quality of the corresponding bit was below 51 percent; the higher the count per block, the poorer the quality and the higher the probability of errors in the data (1×10^{-1} is a higher count than 1×10^{-3}).

C-2. PROCEDURE FOR ALPHA FLUNK COUNT. Connect the BER counter (Harris 7002 or equivalent) to the modem under test as follows:

a. Connect the error input to the BER counter from the modem demodulator BNC connector marked ERROR.

b. Connect the modem BNC connector marked CLOCK to the clock input of the BER counter.

c. Set the modem METER SELECT switch to SIGNAL/NOISE.

d. Take the average of at least 10 blocks for alpha flunk count.

APPENDIX D

TEST DATA SHEETS

This appendix provides the test data sheets to be used in recording the test data derived from the test procedures in section 7 of this SEIP. The test data sheets apply to the individual test procedures as follows:

Form number	Procedure	Paragraph
	Performance Testing of the Digital Data Modem MD-920/G	7.7
01-R (T)	Impedance Measurements	7.7.4
02-R (T)	Output Voltage and Level Stability	7.7.5
03-R (T)	BER and Alpha Flunk Versus E_b/N_o	7.7.6
	Performance Testing of the MD-921/G or MD-1002/G Modem	7.8
04-R (T)	Output Power Level Measurement	7.8.5
04-R (T)	Output Frequency Accuracy	7.8.6
05-R (T)	Demodulator Dynamic Range	7.8.7
06-R (T)	BER and Alpha Flunk Versus E_b/N_o Looped Back at IF Patch	7.8.8
07-R (T)	IF Filter Insertion Loss and Bandwidth	7.8.8.2a
08-R (T)	IF Filter Dynamic Range	7.8.8.2b
09-R (T)	BER and Alpha Flunk Versus E_b/N_o Looped Back Through Frequency Conversion Subassembly	7.8.9
10-R (T)	BER and Alpha Flunk Versus E_b/N_o Looped Back at Distant End	7.8.10
	Performance Testing of Multiplexer Set AN/GSC-24(V)	7.9
11-R (T)	RT Card Calibration	7.9.5
11-R (T)	Phase and Amplitude Jitter	7.9.6
11-R (T)	Bit Error Rate	7.9.7
	Performance Testing of Group Data Modem AN/USC-26	7.10
12-R (T)	Impedance Measurements	7.10.4
13-R (T)	Output Power and Noise Levels	7.10.5
13-R (T)	Phase Jitter and Digital Signal-to-Noise	7.10.6
13-R (T)	BER Versus Signal Level	7.10.7

Form number	Procedure	Paragraph
	Performance Testing of Analog-to-Digital Converter CV-3034A/G	7.11
14-R (T)	Impedance Measurements	7.11.4
15-R (T)	BER Versus Attenuation	7.11.5
15-R (T)	Test Tone Versus Frequency	7.11.6
15-R (T)	Phase Jitter	7.11.7
15-R (T)	Harmonic Distortion Ratio	7.11.8
15-R (T)	Frequency Translation	7.11.9
	Performance Testing of Frequency Division Multiplex (FDM) and Microwave Radio (M/W) Equipment	7.12
16-R (T)	FDM Group Transmit and Receive Impedance	7.12.4
17-R (T)	FDM Group Frequency Response	7.12.5
18-R (T)	FDM Group Idle Noise	7.12.6
19-R (T)	FDM Group and M/W Radio NPR and BINR	7.12.7
20-R (T)	FDM Group Phase Jitter	7.12.8
21-R (T)	FDM Group Envelope Delay Distortion	7.12.9
22-R (T)	FDM Group Impulse Noise Measurement	7.12.10
	Performance Testing of Metallic Cable Pairs	7.13
23-R (T)	Cable Pair Phase Jitter	7.13.5
24-R (T)	Low Frequency Signal-to-Noise Ratio	7.13.6
25-R (T)	Wideband Signal-to-Noise Ratio	7.13.7
26-R (T)	Impulse Noise	7.13.8
27-R (T)	Net Loss Variation	7.13.9
28-R (T)	Line-Up Loss	7.13.10
29-R (T)	Envelope Delay Distortion	7.13.11
30-R (T)	Nominal Data Levels	7.13.12
30-R (T)	Bit Error Rate	7.13.13
30-R (T)	Minimum Longitudinal Balance	7.13.14
	Performance Testing of AN/FTC-31 to AN/FTC-31 or AN/FTC-31 to WECO 758C Automatic Switches	7.14
31-R (T)	Bit Error or Burst Error Rate	7.14.4
32-R (T)	Channel Impedance	7.14.5
33-R (T)	Isochronous Jitter to Terminal Equipment	7.14.6
33-R (T)	Isochronous Jitter from Terminal Equipment	7.14.7
34-R (T)	Nominal Input and Output Signal Level	7.14.8

Form number	Procedure	Paragraph
	<u>Performance Testing of Voice Quality Circuits Between Switchboards (KY-3 to KY-3)</u>	7.15
35-R (T)	Frequency Response and Insertion Loss	7.15.5
36-R (T)	Maximum Change in Frequency	7.15.6
36-R (T)	Idle Channel Noise Level	7.15.7
36-R (T)	Impulse Noise	7.15.8
36-R (T)	Harmonic Distortion	7.15.9
36-R (T)	Phase Jitter	7.15.10
	<u>Performance Testing of Video Cables</u>	7.16
37-R (T)	Impedance Measurements	7.16.4
38-R (T)	Insertion Loss and Frequency Response	7.16.5
39-R (T)	Phase Jitter Measurement	7.16.6
40-R (T)	Crosstalk	7.16.7
40-R (T)	BER Measurement	7.16.8
	<u>Performance Testing of KY-3 Secure Voice Terminal</u> (Note: Refer to TM-11-5805-620-14 for test procedure and data sheets)	7.17
	Signal-to-Noise Ratio	7.17.5
	Frequency Response	7.17.6
	Frequency Distortion	7.17.7
	Impulse Noise	7.17.8
	Frequency Translation	7.17.9
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41-R (T)	<u>Impairment Losses as Transmission Media Are Lengthened and/or Conditioning Equipment Is Added</u>	7.18
	<u>Performance Testing of SECORD Wideband Trunk Applique Unit</u>	7.19
42-R (T)	AN/FTC-31 WB Subscriber Call Placement	7.19.5
43-R (T)	SECORD WB Subscriber Call Placement	7.19.6
44-R (T)	Preemption Call Placement By AN/FTC-31 WB Subscriber	7.19.7
45-R (T)	Preempt Out	7.19.8

MD-920/G MODEM IMPEDANCE MEASUREMENTS (SEIP 035)					
Date:	Site ident:		Device:		
Specified Z:	Bal/unbal:		TLP:		
Trunk:	Circuit ident:		Distant station:		
Frequency (kHz)	E_1		E_2		Impedance (ohms)
	Volts	dBm	Volts	dBm	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 01-R (T)
1 MAR 79

Figure D-1. USACEEIA Form 01-R(T).

MD-920/G OUTPUT VOLTAGE LEVEL AND STABILITY (SEIP 035)

Date: Site ident: Modem ident:

Test point: TLP: Impedance:

Trunk: Circuit ident: Distant station:

Frequency or data rate	Level		Amplitude jitter (Vp-p)	Phase jitter (°p-p)
	Voltage (p-p)	Power (dBm)		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM O2-R (T)
1 MAR 79

Figure D-2. USACEEIA Form O2-R(T).

MD-920/G MODEM BIT ERROR RATE AND ALPHA FLUNK VERSUS E_b/N_o
(SEIP 035)

Date:	Site ident:	Modem ident:
Data rate:	Symbol rate:	Threshold E_b/N_o:
Trunk:	Circuit ident:	Distant station:

E_b/N_o (dB)	Bit error rate	Alpha flunk

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 03-R (T)
1 MAR 79

Figure D-3. USACEEIA Form 03-R(T).

MD-921/G OR MD-1002/G MODEM OUTPUT POWER LEVEL AND FREQUENCY ACCURACY MEASUREMENT
(SEIP 035)

Date: Site ident: Modem ident:

Data rate: Test point: Impedance:

Trunk: Circuit ident: Distant station:

Power output (dBm)		Frequency		
CW	WB	Assigned (MHz)	Measured (MHz)	Accuracy (%)

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 04-R (T)
1 MAR 79

Figure D-4. USACEEIA Form 04-R(T).

MD-921/G OR MD-1002/G MODEM DEMODULATOR DYNAMIC RANGE (SEIP 035)

Date: Site ident: Modem ident:

Data rate: Symbol rate: Coded/uncoded:

Trunk: Circuit ident: Distant station:

Input E_b/N_o (dB)	S/N (dB)	AGC (volts)	Bit sync (on/off)	Phase lock (on/off)	Power (on/off)

BER test lost bit sync ______ E_b/N_o

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 05-R (T)
1 MAR 79

Figure D-5. USACEEIA Form 05-R(T).

MD-921/G OR MD-1002/G MODEM BIT ERROR RATE AND ALPHA FLUNK VERSUS E_b/N_o LOOPED BACK AT IF PATCH (SEIP 035)

Date: Site ident: Modem ident:

Data rate: Symbol rate: E_b/N_o threshold:

Trunk: Circuit ident: Distant station:

E_b/N_o (dB)	Without IF filters		With IF filters	
	BER	Alpha flunk	BER	Alpha flunk
19.0				
17.0				
15.0				
13.0				
11.0				
9.0				
7.5				
7.0				
6.5				
6.0				
5.5				
5.0				
4.5				
4.0				
2.0				
1.0				
0.0				

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 06-R (T)
1 MAR 79

Figure D-6. USACEEIA Form 06-R(T).

MD-921/G OR MD-1002/G MODEM IF FILTER INSERTION LOSS AND BANDWIDTH TEST (SEIP 035)		
Date:	Site ident:	Filter ident Tx: Rx:
Data rate:	Symbol rate:	Specified BW (MHz):
Center frequency (MHz):	Reference Level (dBm):	Model:
± 0.5 dB BW:	± 1.0 dB BW:	-3.0 dB BW:
Trunk:	Circuit ident:	Distant station:

Frequency (MHz)	Input level (dBm)	Output level (dBm)	Relative gain/ loss (± dB)

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 07-R (T)
1 MAR 79

Figure D-7. USACEEIA Form 07-R(T).

MD-921/G OR MD-1002/G MODEM IF FILTER DYNAMIC RANGE
(SEIP 035)

Date: Site ident: Filter ident:

Data rate: Symbol rate: Specified BW (MHz):

Center frequency. 0.5 dB compression point: Model:

Trunk: Circuit ident: Distant station:

Input level (dBm)	Output level (dBm)	Gain/loss (dB)	Compression (yes/no)

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 08-R (T)
1 MAR 79

Figure D-8. USACEEIA Form 08-R(T).

MD-921/G OR MD-1002/G MODEM BIT ERROR RATE AND ALPHA FLUNK VERSUS E_b/N_o LOOPED BACK THROUGH FREQUENCY CONVERSION SUBASSEMBLY (SEIP 035)

Date: Site ident: Filter ident:

Data rate: Symbol rate: E_b/N_o threshold:

Trunk: Circuit ident: Distant station:

E_b/N_o (dB)	BER	Alpha flunk	C/kT
19.0			
17.0			
15.0			
13.0			
11.0			
9.0			
8.0			
7.5			
7.0			
6.5			
6.0			
5.5			
5.0			
4.5			
4.0			
2.0			
0.0			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 09-R (T)
1 MAR 79

Figure D-9. USACEEIA Form 09-R(T).

MD-921/G OR MD-1002/G MODEM BIT ERROR RATE AND ALPHA FLUNK VERSUS E_b/N_o LOOPED BACK AT DISTANT END (SEIP 035)

Date: Site ident: Modem ident:

Data rate: Symbol rate: E_b/N_o threshold:

Trunk: Circuit ident: Distant station:

BPSK operation				QPSK operation			
E_b/N_o	BER	Alpha flunk	C/kT	E_b/N_o	BER	Alpha flunk	C/kT
19.0				19.0			
17.0				17.0			
15.0				15.0			
13.0				13.0			
12.5				11.0			
12.0				9.0			
11.5				7.5			
11.0				7.0			
10.5				6.5			
10.0				6.0			
9.5				5.5			
9.0				5.0			
8.5				4.5			
8.0				4.0			
6.0				2.0			
4.0				0.0			
2.0							
0.0							

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 10-R (T)
1 MAR 79

Figure D-10. USACEEIA Form 10-R(T).

MULTIPLEXER SET AN/GSC-24(V) RT CARD CALIBRATION,
PHASE AND AMPLITUDE JITTER, AND BER MEASUREMENTS
(SEIP 035)

Date:	Site ident:	Multiplexer ident:
Data rate:	Symbol rate:	Normal number of users:
Trunk:	Circuit ident:	Distant station:

Y-1 frequency	Transition encoding signal frequency
Assigned:	Assigned: 4800 Hz ± 0.25 Hz
Measured:	Measured:
Accuracy:	Accuracy:

Phase jitter (degrees)	Amplitude jitter (Volts p-p and dB)
Per figure 7.9-2 _____°	Per figure 7.9-2 _____Vp-p _____dB
Per figure 7.9-3 _____°	Per figure 7.9-3 _____Vp-p _____dB
Per figure 7.9-4 _____°	Per figure 7.9-4 _____Vp-p _____dB
Per figure 7.9-5 _____°	Per figure 7.9-5 _____Vp-p _____dB

Users	Bit error rate
1	
2	
3	
4	
5	
6	
7	
8	
9	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 11-R (T)
1 MAR 79

Figure D-11. USACEEIA Form 11-R(T).

GROUP DATA MODEM AN/USC-26 IMPEDANCE MEASUREMENTS
(SEIP 035)

Date: Site ident: Device:

Specified Z: Bal/unbal: TLP:

Trunk: Circuit ident: Distant station:

Frequency (kHz)	E_1		E_2		Impedance (ohms)
	Volts	dBm	Volts	dBm	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 12-R (T)
1 MAR 79

Figure D-12. USACEEIA Form 12-R(T).

GROUP DATA MODEM AN/USC-26 PHASE JITTER, DIGITAL SIGNAL-TO-NOISE, AND BER VERSUS SIGNAL LEVEL MEASUREMENTS (SEIP 035)

Date: Site ident: Modem ident:

Data rate: Group bandwidth: Digital signal level: ________Vp-p

Trunk: Circuit ident: Distant station:

Analog ouput power level: Output signal-to-noise ratio:

Phase jitter in degrees:____° Digital signal to noise: ______Vp-p, _______dB

Attenuation (dB)	Bit error rate

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 13-R (T)
1 MAR 79

Figure D-13. USACEEIA Form 13-R(T).

ANALOG-TO-DIGITAL CONVERTER CV-3034A/G IMPEDANCE MEASUREMENTS (SEIP 035)

Date:	Site ident:	Device:
Specified Z:	Bal/unbal:	TLP:
Trunk:	Circuit ident:	Distant station:

Frequency (kHz)	E_1		E_2		Impedance (ohms)
	Volts	dBm	Volts	dBm	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 14-R (T)
1 MAR 79

Figure D-14. USACEEIA Form 14-R(T).

ANALOG-TO-DIGITAL CONVERTER CV-3034A/G BER VERSUS ATTENUATION, TEST TONE VERSUS FREQUENCY, PHASE JITTER, HARMONIC DISTORTION RATIO, AND FREQUENCY TRANSLATION MEASUREMENTS (SEIP 035)

Date: Site ident: Converter ident:

Data rate: Circuit ident: Trunk: Distant station:

Attenuation (dB)	Bit error rate

Test tone level at 1000 Hz __________dBm
Test tone level at 25 kHz __________dBm

Phase jitter measurements

Parameter	1020 Hz	25 kHz	50 kHz
Phase jitter			
Coincidence			
Phase hits			
Amplitude hits			
Dropouts			

Harmonic distortion ratio (dB)	Frequency translation error (%)
1020 Hz __________dB	1020 Hz __________%
25 kHz __________dB	25 kHz __________%
50 kHz __________dB	50 kHz __________%

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 15-R (T)
1 MAR 79

Figure D-15. USACEEIA Form 15-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP INPUT AND OUTPUT IMPEDANCE MEASUREMENTS
(SEIP 035)

Date: Site ident: FDM type:

Specified Z: Bal/unbal: TLP:

Trunk: Circuit ident: Distant station:

Group input				Group output			
Frequency (kHz)	E_1 (Vp-p)	E_2 (Vp-p)	Z (ohms)	Frequency (kHz)	E_1 (Vp-p)	E_2 (Vp-p)	Z (ohms)
60				60			
64				64			
72				72			
76				76			
80				80			
92				92			
96				96			
100				100			
104				104			
108				108			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 16-R (T)
1 MAR 79

Figure D-16. USACEEIA Form 16-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP FREQUENCY RESPONSE AND PILOT TONE LEVEL MEASUREMENTS (SEIP 035)

Date:	Site ident:	Device:
Data rate:	Symbol rate:	Distance (mi/km):
Tx TLP:	Rx TLP:	Tx Z:
Rx Z:	Gp No.:	SGp No.:
Trunk:	Circuit ident:	Distant station:

Test frequency	Tx level	Rx level	Rel level ($\pm$ dB)
60			
64			
68			
72			
76			
80			
84 f_c			
88			
92			
96			
100			
104			
108			
Pilot tone			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 17-R (T)
1 MAR 79

Figure D-17. USACEEIA Form 17-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP IDLE NOISE
(SEIP 035)

Date: Site ident: FDM type:

TLP: Baseband level: Xmt ______ Rcv ______

Trunk: Circuit ident: Distant station:

Noise center frequency (kHz)	Noise level (dBm0)

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 18-R (T)
1 MAR 79

Figure D-18. USACEEIA Form 18-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP NOISE POWER AND INTRINSIC NOISE RATIO
(SEIP 035)

Date:	Site ident:	Device:
Data rate:	Symbol rate:	Distance (mi/km):
TLP:	M/W sys BBL:	WB traffic level:
Tx level:	Receive level:	Tx Z:
Rx Z:	Group No.:	SGp No.:

Noise Slots

Parameter	Calculated loading level			TLP level		
	70 kHz	105 kHz	Separation	70 kHz	105 kHz	Separation
BINR (dB)						
NPR (dB)						

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 19-R (T)
1 MAR 79

Figure D-19. USACEEIA Form 19-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP PHASE JITTER MEASUREMENT (SEIP 035)

Date:	Site ident:	Device:
Data rate:	Symbol rate:	Distance (mi/km):
Tx TLP:	Rx TLP:	Tx Z:
Rx Z:	Gp No.:	SGp No.:
Test freq:	Pilot freq:	
Trunk:	Circuit ident:	Distant station:

Test frequency (kHz)	P-p phase jitter	Amplitude hits	Coincidence hits	Phase hits	Dropouts
Pilot frequency					

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 20-R (T)
1 MAR 79

Figure D-20. USACEEIA Form 20-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP ENVELOPE DELAY DISTORTION (SEIP 035)

Date:	Site ident:	Device:
Data rate:	Symbol rate:	Distance : (mi/km)
Tx TLP:	Rx TLP:	Tx Z:
Rx Z:	Ref frequency:	Ref delay:
Trunk:	Circuit ident:	Distant station:

Frequency (kHz)	Delay (μs)	Relative delay (μs)
60		
64		
68		
72		
76		
80		
84 f_c		
88		
92		
96		
100		
104		
108		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 21-R (T)
1 MAR 79

Figure D-21. USACEEIA Form 21-R(T).

FREQUENCY DIVISION MULTIPLEX GROUP IMPULSE NOISE MEASUREMENT (SEIP 035)

Date:	Site ident:	Device:
Data rate:	Symbol rate:	Distance: (mi/km)
Tx TLP:	Rx TLP:	Tx Z:
Rx Z:	Test tone level:	Gp No.:
SGp No.:	Trunk:	Circuit ident:
Distant station:	Test freq No. 1:	

Threshold settings			Count total in 15-minute period
Range	dBrnC	dBrnCO	
Low			
Mid			
High			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 22-R (T)
1 MAR 79

Figure D-22. USACEEIA Form 22-R(T).

CABLE PAIR PHASE JITTER MEASUREMENTS
(SEIP 035)

Date: Site ident: Device:

Data rate: Symbol rate: End-to-end/loopback:

Trunk: Circuit ident: Distant station:

End-to-end

Test frequency	P-p phase jitter	Phase hits	Coincidence hits	Dropouts	Amplitude hits
1000 Hz					
26 kHz					
50 kHz					

Loopback

Test frequency	P-p phase jitter	Phase hits	Coincidence hits	Dropouts	Amplitude hits
1000 Hz					
26 kHz					
50 kHz					

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 23-R (T)
1 MAR 79

Figure D-23. USACEEIA Form 23-R(T).

CABLE PAIR LOW FREQUENCY SIGNAL-TO-NOISE RATIO (SEIP 035)			
Date:	Site ident:	Cable pair:	
Data rate:	Symbol rate:	Distance: (mi/km)	
Trunk:	Subscriber:	Distant station:	
Test frequency (Hz)	Tx tone level (dBm)	Noise level (dBm)	S/N (dB)
50			
60			
120			
240			
360			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 24-R (T)
1 MAR 79

Figure D-24. USACEEIA Form 24-R(T).

CABLE PAIR WIDEBAND SIGNAL-TO-NOISE RATIO
(SEIP 035)

Date: | Site ident: | Cable pair No.:

Data rate: | Symbol rate: | Distance: (mi/km)

Trunk ident: | Subscriber: | Distant station:

600-ohm measurement

Test frequency (kHz)	Tone level (dBm)		Noise level (dBm)	
	End-to-end	Loopback	End-to-end	Loopback
1.2				
25.0				
50.0				

130-ohm measurement

Test frequency (kHz)	Tone level (dBm)		Noise level (dBm)	
	End-to-end	Loopback	End-to-end	Loopback
1.2				
25.0				
50.0				

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 25-R (T)
1 MAR 79

Figure D-25. USACEEIA Form 25-R(T).

CABLE PAIR IMPULSE NOISE MEASUREMENT (SEIP 035)			
Date:	Site ident:		Device:
Data rate:	Symbol rate:		Distance: (mi/km)
Tx TLP:	Rx TLP:		Tx Z:
Rx Z:	Test tone load:		Gp No.:
SGp No.:	Trunk:		Circuit ident:
Distant station:			Test freq No. 1:
600-ohm termination threshold settings			
Range	dBrnC	dBrnCO	Count total in 15-minute period
Low			
Mid			
High			
135-ohm termination threshold settings			
Range	dBrnC	dBrnCO	Count total in 15-minute period
Low			
Mid			
High			
Comments:			
	(Typed or printed)		(Signature)

USACEEIA FORM 26-R (T)
1 MAR 79

Figure D-26. USACEEIA Form 26-R(T).

CABLE PAIR NET LOSS VARIATION
(SEIP 035)

Date: | Site ident: | Modem ident:
Data rate: | Symbol rate: | Distance: (mi/km)
Trunk: | Subscriber: | Distant station:

Variation at 1000 Hz and 600 ohms

15-minute test period	Max deviation above reference (dB)	Max deviation below reference (dB)	Max net variation (dB)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

This test continued on next page.

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 27-R (T)
1 MAR 79

Figure D-27. USACEEIA Form 27-R(T).

CABLE PAIR NET LOSS VARIATION (CONTD)
(SEIP 035)

Date: Site ident:

Variation at 1000 Hz and 600 ohms

15-minute test period	Max deviation above reference (dB)	Max deviation below reference (dB)	Max net variation (dB)
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			

Variation at 25 kHz and 135 ohms

15-minute test period	Max deviation above reference (dB)	Max deviation below reference (dB)	Max net variation (dB)
1			
2			
3			
4			

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 27-1-R(T)
1 MAR 79

Figure D-27-1.

CABLE PAIR LINE-UP LOSS TEST
(SEIP 035)

Date: Site ident: Cable pair Z:

Data rate: Symbol rate: Distance: (mi/km)

Trunk: Subscriber: Distant station:

Test frequency at 600 ohms	Tx level (dBm)	Rx level (dBm)	Loss (dBm)	Relative amp (± dB)
100 Hz				
1000 Hz				
3000 Hz				
5500 Hz				
10,000 Hz				
18,000 Hz				
25,000 Hz				
32,000 Hz				
50,000 Hz				

Test frequency at 135 ohms	Tx level (dBm)	Rx level (dBm)	Loss (dBm)	Relative amp (± dB)
100 Hz				
1000 Hz				
3000 Hz				
5500 Hz				
10,000 Hz				
18,000 Hz				
25,000 Hz				
32,000 Hz				
50,000 Hz				

Comments:

Test director ______________________ ______________________
(Typed or printed) (Signature)

USACEEIA FORM 28-R (T)
1 MAR 79

Figure D-28. USACEEIA Form 28-R(T).

CABLE PAIR ENVELOPE DELAY DISTORTION
(SEIP 035)

Date:	Site ident:	Cable pair:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Subscriber:	Distant station:
Reference freq:	Reference delay:	Mode:

Frequency (kHz)	Absolute delay (μs)	Relative delay (μs)
4		
6		
8		
10		
12		
14		
16		
18		
20		
22		
24		
26		
28		
30		
32		
34		
36		
38		
40		
42		
44		
46		
48		
50		
52		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 29-R (T)
1 MAR 79

Figure D-29. USACEEIA Form 29-R(T).

CABLE PAIR MULTIPLE TESTS
(SEIP 035)

Date:	Site ident:	Cable pair No.:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Subscriber:	Distant station:

Configuration	dBm	Vp-p
600-ohm balanced line transceiver	Xmt Rcv	Xmt Rcv
135-ohm balanced line transceiver	Xmt Rcv	Xmt Rcv
KY-3 user	Xmt Rcv	Xmt Rcv

Bit error rate

Parameter	At 50 kb/s	At 2400 b/s
Total bits transmitted		
Total errors received		
Bit error rate		

Longitudinal balance __________ dB

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 30-R (T)
1 MAR 79

Figure D-30. USACEEIA Form 30-R(T).

AN/FTC-31 BIT ERROR OR BURST ERROR RATE (SEIP 035)				
Date:		Site ident:		Sheet No.:
Data rate:		Symbol rate:		Distance: (mi/km)
Trunk:		Local switchboard:		Distant switchboard:
BER	No. of samples	Subtotal errors	Subtotal bits	Ordinate value (%)
Actual BER	Total No. samples	Total errors	Total bits	
Comments:				
		(Typed or printed)		(Signature)

USACEEIA FORM 31-R (T)
1 MAR 79

Figure D-31. USACEEIA Form 31-R(T).

AN/FTC-31 CHANNEL IMPEDANCE MEASUREMENTS
(SEIP 035)

Date:	Site ident:	Mode:
Specified impedance:	Symbol rate:	Distance: (mi/km)
Trunk:	Local subscriber:	Distant subscriber:

Frequency (kHz)	E_1		E_2		Impedance (ohms)
	Volts	dBm	Volts	dBm	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 32-R (T)
1 MAR 79

Figure D-32. USACEEIA Form 32-R(T).

AN/FTC-31 ISOCHRONOUS JITTER FROM OR TO TERMINAL EQUIPMENT
(SEIP 035)

Date: Site ident: Mode:

Data rate: Symbol rate: Distance: (mi/km)

Trunk: Local switchboard: Distant switchboard:

Parameter	To terminal equipment	From terminal equipment
Signal level (Vp-p)		
Signal level (V peak) E_1		
Amplitude jitter (Vp-p)		
Amplitude jitter (V peak) E_2		
Phase jitter (° p-p)		
Amplitude distortion (dB)		
(20 log E_1/E_2)		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 33-R (T)
1 MAR 79

Figure D-33. USACEEIA Form 33-R(T).

AN/FTC-31 NOMINAL INPUT AND OUTPUT SIGNAL LEVEL (SEIP 035)		
Date:	Site ident:	Mode:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Local switchboard:	Distant switchboard:
Subscriber to switch		
On hook:	2600-Hz level ________ dBm	
Dialing:	Pulses per sec ____, % break ____, level ___ dBm	
Cipher:	Cipher level ________ dBm	
Ring tone:	1000 Hz @ ________ dBm	
Switch to switch		
On hook:	2600 Hz ________ dBm	
Dial tone:	600 Hz ________ dBm	
Ring tone:	1000 Hz ________ dBm	
Preempt:	800 Hz ________ dBm	
Dialing:	2600 Hz @ ______pps, ______%break, level ______dBm	
Comments:		
	(Typed or printed)	(Signature)

USACEEIA FORM 34-R (T)
1 MAR 79

Figure D-34. USACEEIA Form 34-R(T).

VOICE QUALITY BETWEEN SWITCHBOARDS
FREQUENCY RESPONSE AND INSERTION LOSS
(SEIP 035)

Date: Site ident: Mode:

Data rate: Symbol rate: Distance: (mi/km)

Trunk: Local subscriber: Distant subscriber:

Frequency (Hz)	Level (dBm0)
300	
400	
500	
700	
1000	
1300	
1600	
1900	
2200	
2500	
2800	
3000	
3100	
3200	
3300	
3400	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 35-R (T)
1 MAR 79

Figure D-35. USACEEIA Form 35-R(T).

VOICE QUALITY BETWEEN SWITCHBOARDS MULTIPLE TESTS (SEIP 035)			
Date:	Site ident:		Mode:
Data rate:	Symbol rate:		Distance: (mi/km)
Trunk:	Local subscriber:		Distant subscriber:
Maximum change in frequency (translation error) ________ Hz			
Idle channel noise level ______________________ dBrnCO			
Impulse noise counts			
Threshold settings			Count total in 15-minute period
Range	dBrnC	dBrnCO	
Low			
Mid			
High			
Harmonic distortion ________ % ________ dBmO			
Phase jitter ________ Vp-p ________ °			
Comments:			
(Typed or printed)		(Signature)	

USACEEIA FORM 36-R (T)
1 MAR 79

Figure D-36. USACEEIA Form 36-R(T).

VIDEO CABLE IMPEDANCE MEASUREMENTS
(SEIP 035)

Date: Site ident: Device:

Specified Z: Bal/unbal: TLP:

Trunk: Circuit ident: Distant station:

Frequency (kHz)	E_1		E_2		Impedance (ohms)
	Volts	dBm	Volts	dBm	

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 37-R (T)
1 MAR 79

Figure D-37. USACEEIA Form 37-R(T).

VIDEO CABLE FREQUENCY RESPONSE AND INSERTION LOSS TEST
(SEIP 035)

Date: Site ident: Cable Z_________ohms

Data rate: Symbol rate: Distance: (mi/km)

CCSD: Distant station: Cable type:

Frequency (kHz)	Input level (dBm)	Output level (dBm)	Loss (dB)	Rel level (dB)

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 38-R (T)
1 MAR 79

Figure D-38. USACEEIA Form 38-R(T).

VIDEO CABLE PHASE JITTER MEASUREMENT (SEIP 035)		
Date:	Site ident:	Cable type:
Data rate:	Symbol rate:	Distance: (mi/km)
CCSD:	Cable Z ____ohms	Distant station:

Test frequency	P-p phase jitter	Amplitude hits	Phase hits	Coincidence hits	Dropouts

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 39-R (T)
1 MAR 79

Figure D-39. USACEEIA Form 39-R(T).

<table>
<tr><td colspan="3">VIDEO CABLE CROSSTALK AND BER MEASUREMENTS
(SEIP 035)</td></tr>
<tr><td>Date:</td><td>Site ident:</td><td>Cable Z ______ohms</td></tr>
<tr><td>Data rate:</td><td>Symbol rate:</td><td>Distance:
(mi/km)</td></tr>
<tr><td>CCSD:</td><td>Distant station:</td><td>Cable type:</td></tr>
</table>

Near end	Far end
Tx level __________dBm	Rx level __________dBm
Rx level __________dBm	Tx level __________dBm
Rx idle noise __________dBm	Rx idle noise __________dBm
Crosstalk ________dB	Crosstalk ________dB
Single path BER__________	Single path BER________
Double path BER__________	Double path BER________

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 40-R (T)
I MAR 79

Figure D-40. USACEEIA Form 40-R(T).

TRANSMISSION MEDIA IMPAIRMENT LOSS AS TRANSMISSION MEDIA ARE LENGTHENED AND/OR CONDITIONING EQUIPMENT IS ADDED (SEIP 035)

Date: Site ident: Mode:

Data rate: Symbol rate: Distance: (mi/km)

Looped at	Through	BER

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 41-R (T)
1 MAR 79

Figure D-41. USACEEIA Form 41-R(T).

WIDEBAND TRUNK APPLIQUE UNIT, AN/FTC-31 WIDEBAND
SUBSCRIBER CALL PLACEMENT
(SEIP 035)

Date:	Site ident:	Unit ident:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Local subscriber:	Distant subscriber:

Step number	Accept	Reject
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 42-R (T)
1 MAR 79

Figure D-42. USACEEIA Form 42-R(T).

WIDEBAND TRUNK APPLIQUE UNIT, SECORD WIDEBAND SUBSCRIBER CALL PLACEMENT (SEIP 035)		
Date:	Site ident:	Unit ident:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Local subscriber:	Distant subscriber:

Step number	Accept	Reject
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 43-R (T)
1 MAR 79

Figure D-43. USACEEIA Form 43-R(T).

WIDEBAND TRUNK APPLIQUE UNIT, PREEMPTION CALL PLACEMENT BY
AN/FTC-31 WIDEBAND SUBSCRIBER
(SEIP 035)

Date:	Site ident:	Unit ident:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Local subscriber:	Distant subscriber:

Step number	Accept	Reject
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 44-R (T)
1 MAR 79

Figure D-44. USACEEIA Form 44-R(T).

WIDEBAND TRUNK APPLIQUE UNIT, PREEMPT OUT (SEIP 035)		
Date:	Site ident:	Unit ident:
Data rate:	Symbol rate:	Distance: (mi/km)
Trunk:	Local subscriber:	Distant subscriber:

Step number	Accept	Reject
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Comments:

(Typed or printed) (Signature)

USACEEIA FORM 45-R (T)
1 MAR 79

Figure D-45. USACEEIA Form 45-R(T).

APPENDIX E

TEST EQUIPMENT LISTING

Item code	Instrument type	Recommended model or equivalent	Quantity
001	Precision termination, 50-ohm ±1%, BNC		4
002	Double balanced mixer	HP-10514A	4
003	Low gain dc oscillograph amplifier	HP-8801A (PL1390U)	4
004	Distortion measuring set	HP-339A	2
005	Spectrum analyzer mainframe	HP-141T (IP1216PGR)	2
006	Spectrum analyzer	HP-3580A	2
007	Oscilloscope differential amplifier	Tektronix 7A22 (AM6786U)	4
008	Coaxial step attenuator 0-12 dB	HP-355C	3
009	Coaxial step attenuator 0-120 dB	HP-355D	3
010	Coaxial step attenuator 0-11 dB	HP-8494B	2
011	Coaxial step attenuator 0-110 dB	HP-8496B	2
012	Precision termination, 150-ohm ±1%, BNC		4
013	Frequency counter	HP-5340A (TD1225V1U)	2
014	Impulse noise counter	TTS-58A (CP110JU)	2
015	Line transceiver, 75-ohm unbal to 135-ohm bal		2
016	Line transceiver, 135-ohm bal to 75-ohm unbal		2
017	Bit error counter	Harris 7002	2
018	Pattern generator/error detector	HP-3780A	2
019	AM/FM signal generator	HP-8640B	2
020	Power meter	HP-436A	2
021	RF millivoltmeter	Boonton 42B	2
022	Rms voltmeter	HP-3400A (ANUSM224)	4
023	Frequency selective voltmeter	HP-312D	2
024	Digital voltmeter	HP-34702A (ME498U)	2
025	Digital voltmeter	HP-34750A (ID2101U)	2
026	Phase jitter meter	Hekimian HLI-48	2
027	Test oscillator	HP-654A (SG1128U)	4
028	Transmission measuring set	HP-3555B	2
029	Oscilloscope	Tektronix 7603 (ANUSM281C)	2
030	Patch panel	HP-353A	2

Item code	Instrument type	Recommended model or equivalent	Quantity
031	Spectrum analyzer, IF plug-in	HP-8552B (PL1388U)	2
032	Spectrum analyzer, tuning section	HP-8555A (PL1400U)	2
033	Oscilloscope time base plug-in	Tektronix 7B53A	2
034	Thermal printer	HP-5150A	2
035	Oscillographic recorder	HP-7702B (RD460V1U)	2
036	Precision termination, 135 ohm $\pm1\%$, BNC		4
037	Precision termination, 600-ohm $\pm1\%$, BNC		4
038	Precision termination, 75-ohm $\pm1\%$, BNC		4
039	Precision termination, 124-ohm $\pm1\%$, BNC		4
040	Power sensor	HP-8481A	2
041	Automatic synthesizer	HP-3330B	2
042	Envelope delay test set	Sierra 490B (TS2669A)	2
043	E_b/N_o test set	TS-3580	2
044	Balancing transformer, 75-ohm	HP-11473A	2
045	White noise test set	Marconi OA-2090A (ANGSM161A)	2
046	Balancing transformer, 75-ohm unbal to 75-ohm bal		2
047	Balancing transformer, 135-ohm bal to 600-ohm bal		4
048	Balancing transformer, 75-ohm unbal to 135-ohm bal	HP-11474A	4
049	Balancing transformer, 75-ohm unbal to 124-ohm bal	HP-11476A	4
050	Notch filter	Hekimian HLI-94	2
051	Line transceiver, 75-ohm unbal to 600-ohm bal		2
052	Line transceiver, 600-ohm bal to 75-ohm unbal		2
053	Transmission measuring set	AN/USM-181	2
054	Transmission impairment measuring set	HP-4940A	2

APPENDIX F

TEST MEASUREMENT PARAMETERS

Test paragraph number	Test	Measurement parameter	Reference
7.7.5	Output voltage and level stability	a. LOS output: -12 dBm b. RF cable interface output: +23 or +10 or 0 dBm c. Line drivers and receivers: 6 volts p-p $\pm$1.5 V	TM-11-5820-804-12, pages 1-3 & 1-4
7.7.6	Bit error rate and alpha flunk versus E_b/N_o	IF loop coded or uncoded implementation loss of 1.8 dB defined at a BER of less than 1 x 10^{-6}	TM-11-5820-804-12, page 2-6, figure 2-7
7.8.5	Output power test	a. MD-921/G: +10 dBm b. MD-1002/G: +10.5 dBm $\pm$0.5 dB	a. TM-11-5820-803-12, page 1-6 b. TM-11-5820-847-34, page 3-24
7.8.6	Frequency accuracy	a. MD-921/G: 70 MHz $\pm$1.0 kHz b. MD-1002/G: 70 MHz $\pm$1.0 kHz	a. TM-11-5820-803-12, page 1-6 b. TM-11-5820-847-34, page 2-26
7.8.7	Dynamic range test	MD-921/G: per TM-11-5820-803-12 MD-1002/G: per TM-11-5820-847-12	TM-11-5820-803-12 TM-11-5820-847-12
7.8.8	Bit error rate versus alpha flunk looped back at IF	IF loopback: implementation loss of less than 1.8 dB at defined BER of less than 1 x 10^{-6}	TM-11-5820-803-12, page 2-5, figure 2-4 (MD-921/G); TM-11-5820-847-34, pages 3-48 & 3-49; see figure 2-8-1A for alpha flunk
7.8.8	IF loopback through filters	Objective impairment loss of less than 2.0 dB at defined BER of less than 1 x 10^{-6}	Experimental (normally equal to IF implementation loss)

Test paragraph number	Test	Measurement parameter	Reference
7.8.9	RF loopback through frequency conversion subassembly	Objective impairment loss of less than 2.0 dB at defined BER of less than 1×10^{-6}	Experimental (normally less than 2.0 dB and possible pickup of phase noise)
7.8.10	RF loopback through satellite and earth terminal to earth terminal	Less than 3.4 dB defined at BER of less than 1×10^{-6}	DCAC 310-70-57, supplement 6 (ST-38 as modified)
7.9.5	RT card calibration	Frequency accuracy (timing osc): 1 part x 10^7 Frequency accuracy (transition encoding signal): 4800 Hz ± 0.25 Hz	Manufacturer's manual, pages 6-28 through 6-30
7.9.7	Bit error rate test	Single user: less than 1×10^{-7} Multiple users: less than 1×10^{-7}	Objective
7.10.4	Impedance test	Transmitter J-6/receiver J-6; strapped optional impedance $\pm 10\%$ of nominal 75 ohms unbal or 135 or 150 ohms bal	Manufacturer's manual
7.10.5	Power output level test	+5 to -40 dBm	Manufacturer's manual, page 1-4, chapter 1
7.10.6	Phase and amplitude jitter test	Phase: 15° peak-to-peak Amplitude: 30 dB	Objective
7.10.7	Bit error rate and error rate versus attenuation	Less than 1×10^{-7}	Objective

Test paragraph number	Test	Measurement parameter	Reference
7.11.4	Impedance test	±10% of following nominal values-- Input: hybrid mode (J-3) 135 ohms bal Input: hybrid mode (J-9) 135 ohms bal Output: J-4, 75 ohms bal Output: J-5, 75 ohms bal Input: J-8, 75 ohms bal J-10, 600 ohms bal J-1, 600 ohms bal	Objective
7.11.5	Bit error rate vs attenuation	a. Normal less than 1 x 10^{-7} b. Denote attenuation point where BER exceeds 1 x 10^{-5}	Objective
7.11.6	Test tone level versus frequency	Within ±2 dB between 1 and 25 kHz	Objective
7.11.7	Phase jitter	15° peak-to-peak	Objective
7.11.8	Harmonic distortion ratio	-50 dBm0	Objective
7.11.9	Frequency translation	±5 Hz	Objective
7.12.4	Input and output impedance test	±10% of nominal	Table 2f of DCAC 300-175-9 as modified
7.12.5	Frequency response group pilot level measurements	a. Pilot tone level: -20 dBm0 ±0.5 dB b. 0-100 km -1.3 to +1.8 dB 100-201 -2.0 to +2.9 201-402 -2.5 to +4.0 402-804 -2.9 to +4.0 804-1609 -3.3 to +4.9 1609-3218 -4.4 to +4.9 3218-6436 -4.4 to +6.7	Table 2b of DCAC 300-175-9 as modified

Test paragraph number	Test	Measurement parameter	Reference
7.12.6	Slot noise test (3.1 kHz)	-50 dBm0 at path lengths of 0-500 miles (0-804 km) and 3 dB higher as distance is doubled	Table 2j of DCAC 300-175-9 as modified to test
7.12.7	NPR and BINR tests	a. BINR and NPR separation: (1) 3 to 4 dB at calculated loading level (2) 0 dB or equal at TLP level b. NPR: greater than 33 dB	Objective
7.12.8	Phase jitter	15° peak-to-peak	Table 2i of DCAC 300-175-9
7.12.9	Envelope delay distortion	Envelope delay equalized parabolic curve 64-104 kHz, reference 84 kHz	Table 2c of DCAC 300-175-9
		Kilometers / Miles / Relative delay (μs): 0-101 / 0-62.5 / -9.0 to +3.2 101-201 / 62.5-125 / -9.4 to +5.8 201-402 / 125-250 / -9.7 to +8.0 402-805 / 250-500 / -9.9 to +8.5 805-1609 / 500-1000 / -10.1 to +10.5 1609-3219 / 1000-2000 / -10.7 to +13.6 3219-6437 / 2000-4000 / -10.9 to +14.9	
7.12.10	Impulse noise test	Less than 175 count at -10 dBm0 threshold within 15 minutes	DCAC 300-175-9, table 2k
7.13.5	Phase jitter test	Less than 8 hits at peaks of 20 degrees during any 15-minute period above 72 dBrn0	Objective

<table>
<tr><th>Test paragraph number</th><th>Test</th><th>Measurement parameter</th><th>Reference</th></tr>
<tr><td>7.13.6</td><td>Low frequency noise</td><td>Less than -36 dBm0, Z1 through Z3</td><td>Table 2 of DCAC 300-175-9, inclosure 1</td></tr>
<tr><td>7.13.7</td><td>Signal-to-noise-plus-noise test (S/N + N)</td><td>Z1: greater than 20 dB
Z2: greater than 33 dB
Z2: greater than 26 dB sub to sub
Z3: greater than 36 dB</td><td>Table 2 of DCAC 300-175-9, inclosure 1, page 21</td></tr>
<tr><td>7.13.8</td><td>Impulse noise test</td><td>Not more than 1 count per second at the following thresholds:

Z1: 12
Z2: 25
Z2: 18
Z3: 28</td><td>Table 2 of DCAC 300-175-9, inclosure 1, page 21</td></tr>
<tr><td>7.13.9</td><td>Net loss variation test</td><td>±2.0 dB</td><td>Table 2 of DCAC 300-175-9, inclosure 1, page 21</td></tr>
<tr><td>7.13.10</td><td>Line-up loss measurement</td><td><table>
<tr><th>Frequency (kHz)</th><th colspan="4">Line-up loss (dB)</th></tr>
<tr><th></th><th>Z1</th><th>Z2</th><th>Z2</th><th>Z3</th></tr>
<tr><td>0.1</td><td>10</td><td></td><td>3</td><td></td></tr>
<tr><td>1.0</td><td>9</td><td></td><td>3</td><td></td></tr>
<tr><td>3.0</td><td>11</td><td></td><td>5</td><td></td></tr>
<tr><td>5.5</td><td>14</td><td></td><td>8</td><td></td></tr>
<tr><td>10.0</td><td>19</td><td></td><td>13</td><td></td></tr>
<tr><td>18.0</td><td>26</td><td></td><td>20</td><td></td></tr>
<tr><td>25.0</td><td>30</td><td></td><td>24</td><td></td></tr>
<tr><td>32.0</td><td>31</td><td></td><td>25</td><td></td></tr>
<tr><td>50.0</td><td>38</td><td></td><td>28</td><td></td></tr>
<tr><td>0.1-50.0</td><td></td><td>8</td><td></td><td>2</td></tr>
<tr><td>1.0-40.0</td><td></td><td>6</td><td></td><td>1</td></tr>
</table></td><td>Table 2 of DCAC 300-175-9, inclosure 1, page 21</td></tr>
</table>

Test paragraph number	Test	Measurement parameter	Reference
7.13.11	Envelope delay distortion	See graph, figure 1.0, of DCAC 300-175-9, page 23	Page 23 of DCAC 300-175-9, figure 1.0
7.13.12	Nominal data input level	1 volt peak-to-peak Z1, Z2, Z2, Z3	Table 2 of DCAC 300-175-9
7.13.13	Bit error rate test	Less than 3 x 10^{-5} in any 15-minute period	Table 2 of DCAC 300-175-9, inclosure 1, page 21
7.14.4	a. Bit error rate	a. Long term (95%) - less than 1 x 10^{-7} b. Short term - less than 1 x 10^{-5} c. DCA - 15 minutes (98.3%) - less than 3 x 10^{-5}	a. Objective: CCIT b. Objective: CCIT c. DCAC 300-175-9, table 2
	b. Burst errors	Less than 15 (fifty thousand bit block errors) in 15 minutes	
7.15.5	Frequency response	Not more than -2.0 to +6.0 dB between 0.3 and 3.0 kHz	Table 2a of DCAC 310-175-9 (V2 parameters)
7.15.6	Maximum change in frequency	Not more than $\pm$5.0 Hz	Table 2a of DCAC 310-175-9 (V2 parameters)
7.15.7	Idle channel noise	Kilometers / Miles / dBrn0: 0-81 / 0-50 / 31 82-161 / 51-100 / 34 162-644 / 101-400 / 37 645-1609 / 401-1000 / 41 1610-2414 / 1001-1500 / 43 2415-4023 / 1501-2500 / 45 4024-6438 / 2501-4000 / 47 6439-12875 / 4001-8000 / 50 12876-25750 / 8001-1600 / 53	Table 2h of DCAC 310-175-9

Test paragraph number	Test	Measurement parameter	Reference
7.15.8	Impulse noise	Not more than 15 counts in 15 minutes above a reference level of 72 dBrn0	Objective
7.15.9	Harmonic distortion	Less -40 dBm0	Table 2m of DCAC 300-175-9
7.15.10	Phase jitter	Not more than 8 hits in a 15-minute period over 20 degrees	Table 2p of DCAC 300-175-9

(CC-OPS)

FOR THE COMMANDER:

OFFICIAL:

EUGENE J. VITETTA
Colonel, GS
Chief of Staff

Roger G. Tabar

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